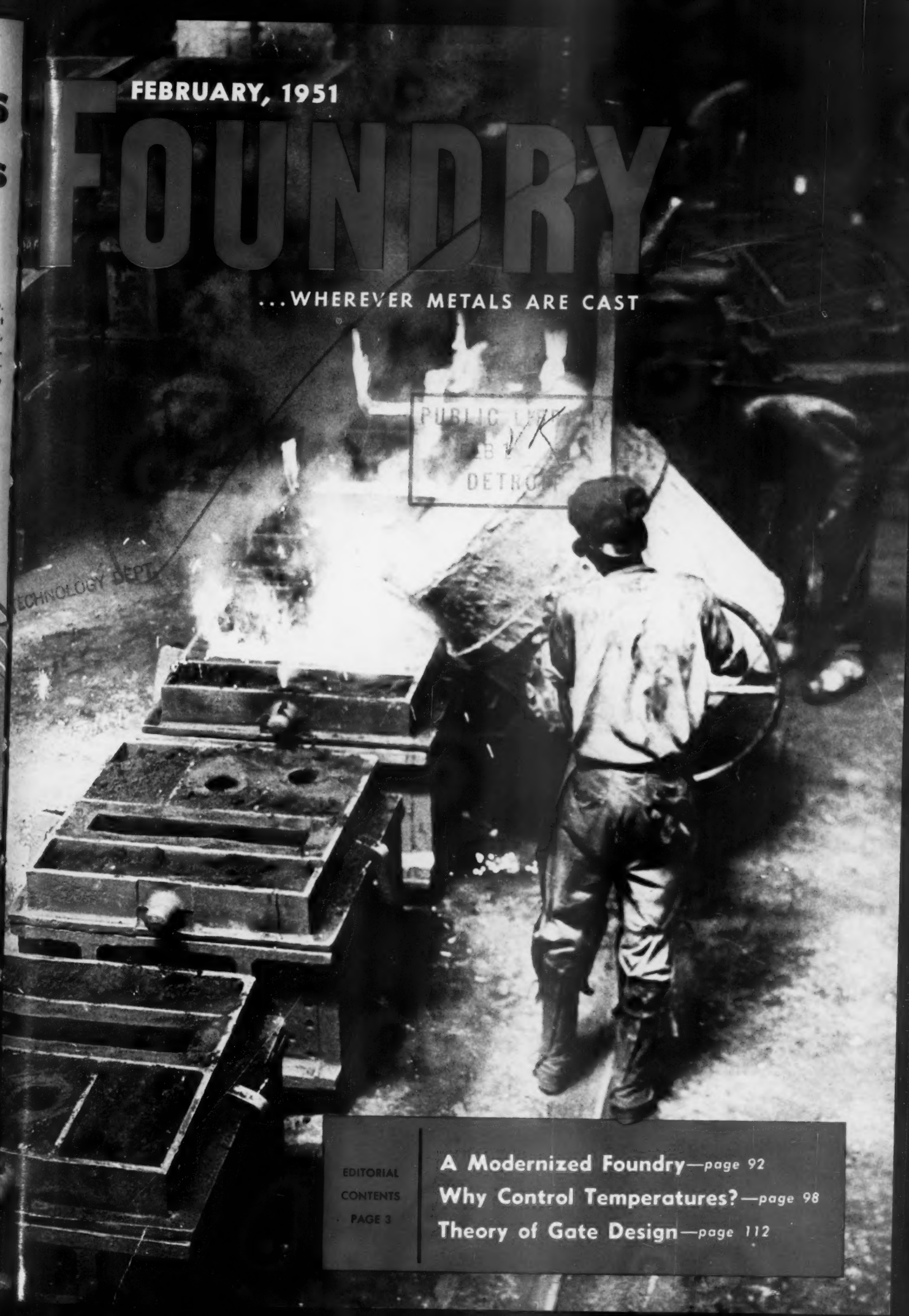
FEBRUARY, 1951

FOUNDRY

...WHEREVER METALS ARE CAST



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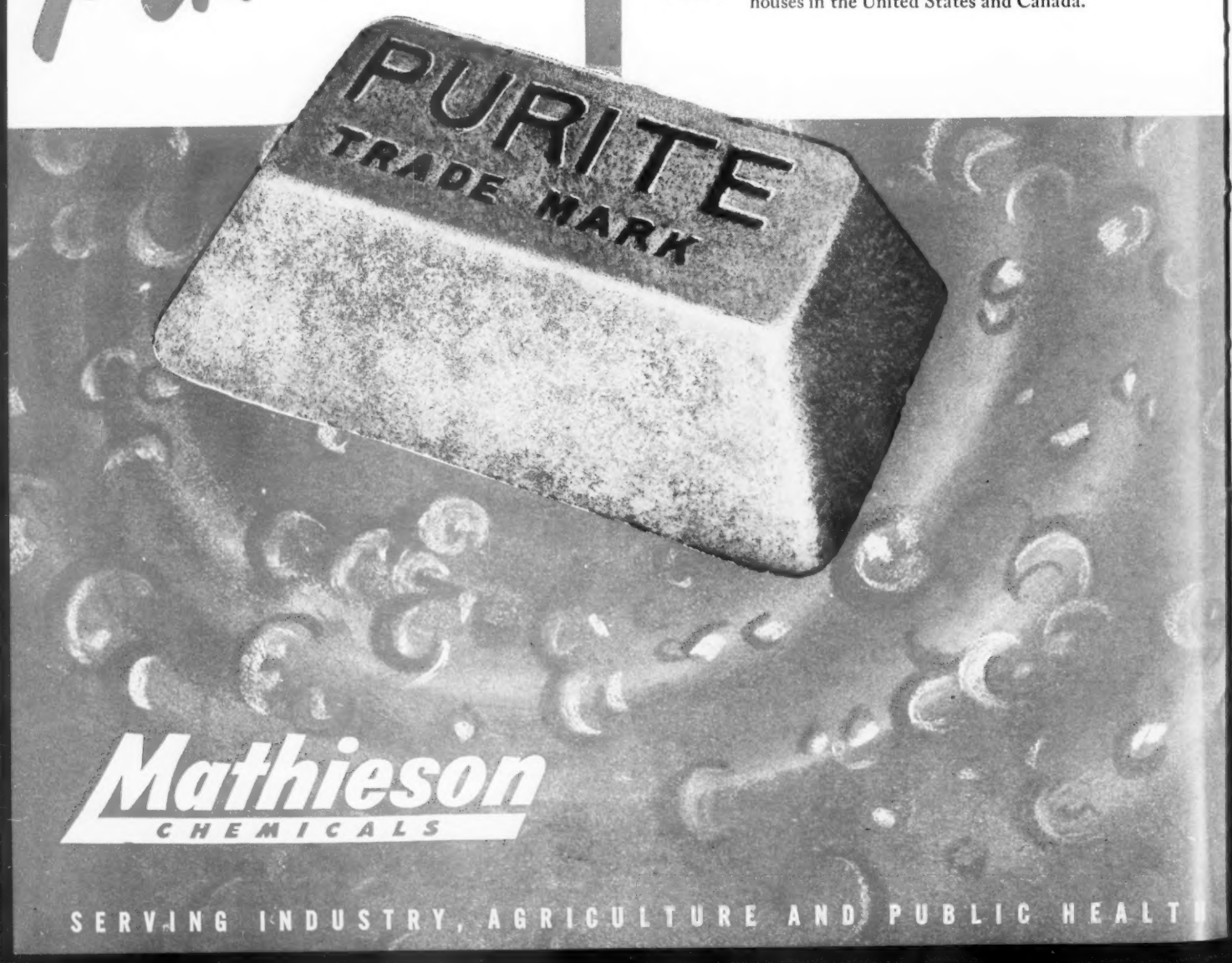

Counsel Offered

ON METAL PROBLEMS

Because of unusually heavy industrial and defense demand, rationing of nickel has been in force since July 1st. On January 1, 1951, National Production Authority Order M-14, respecting the consumption of primary nickel, went into effect.

We shall continue to issue information on new developments and user experience with nickel-containing materials as we believe that dissemination of technical data and service experience can help to promote the intelligent utilization of critical materials, so essential in these times.

"INCO" TECHNICAL SECTIONS

Consultation on technical problems relating to alloys containing nickel is invited. Consult the nearest Technical Field Section of INCO Development and Research Division listed below:

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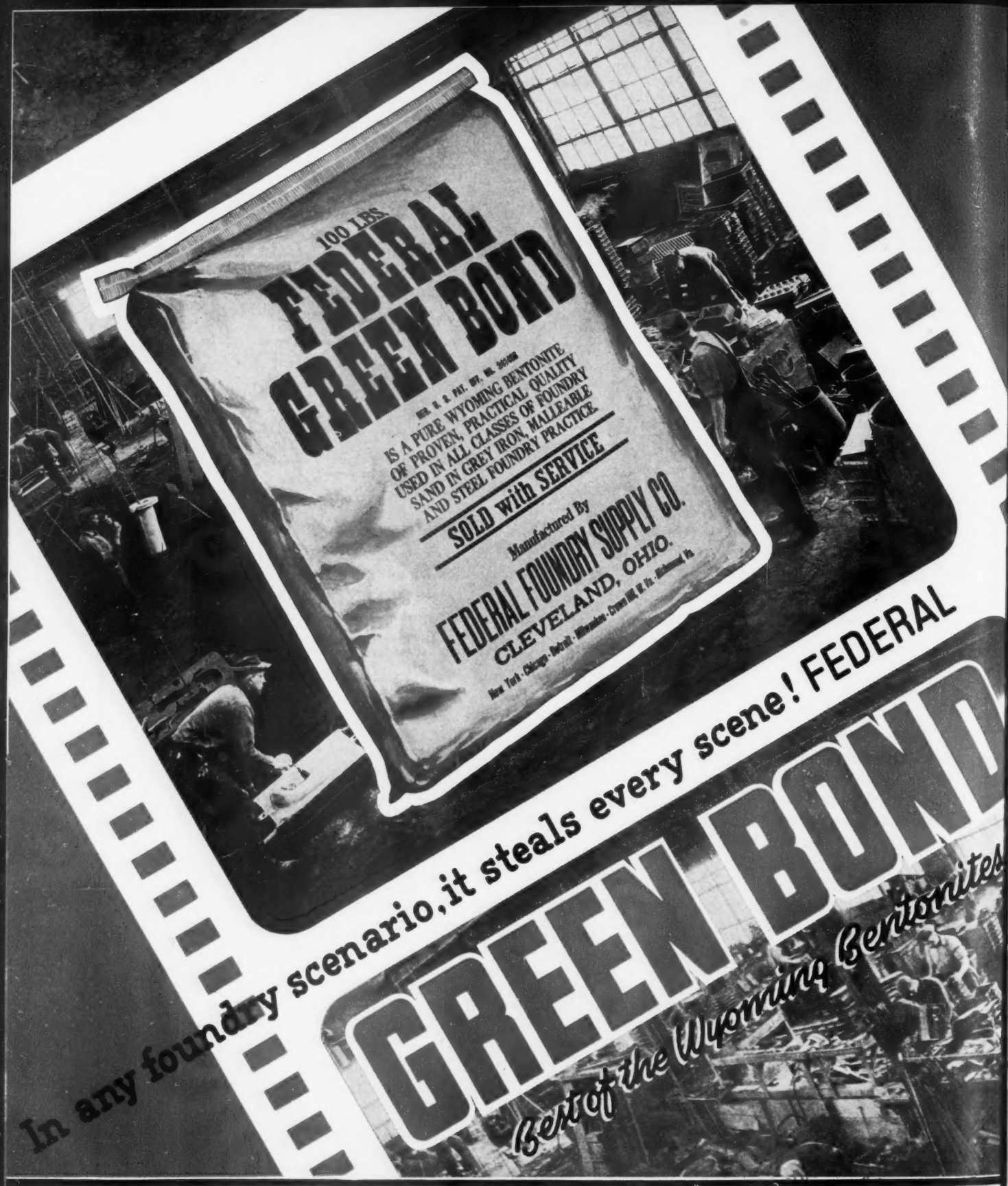

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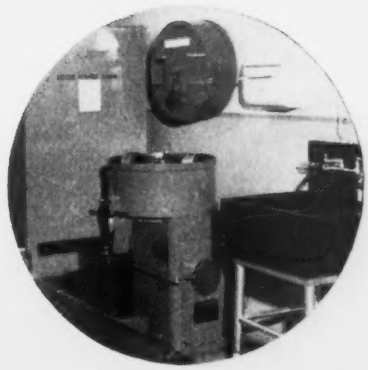

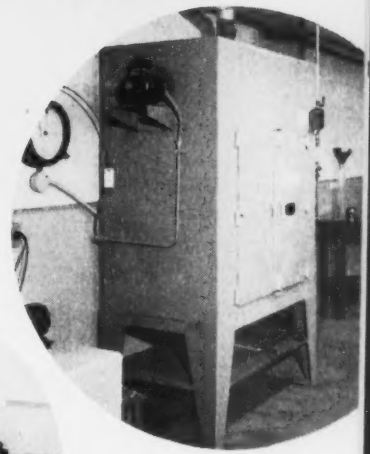

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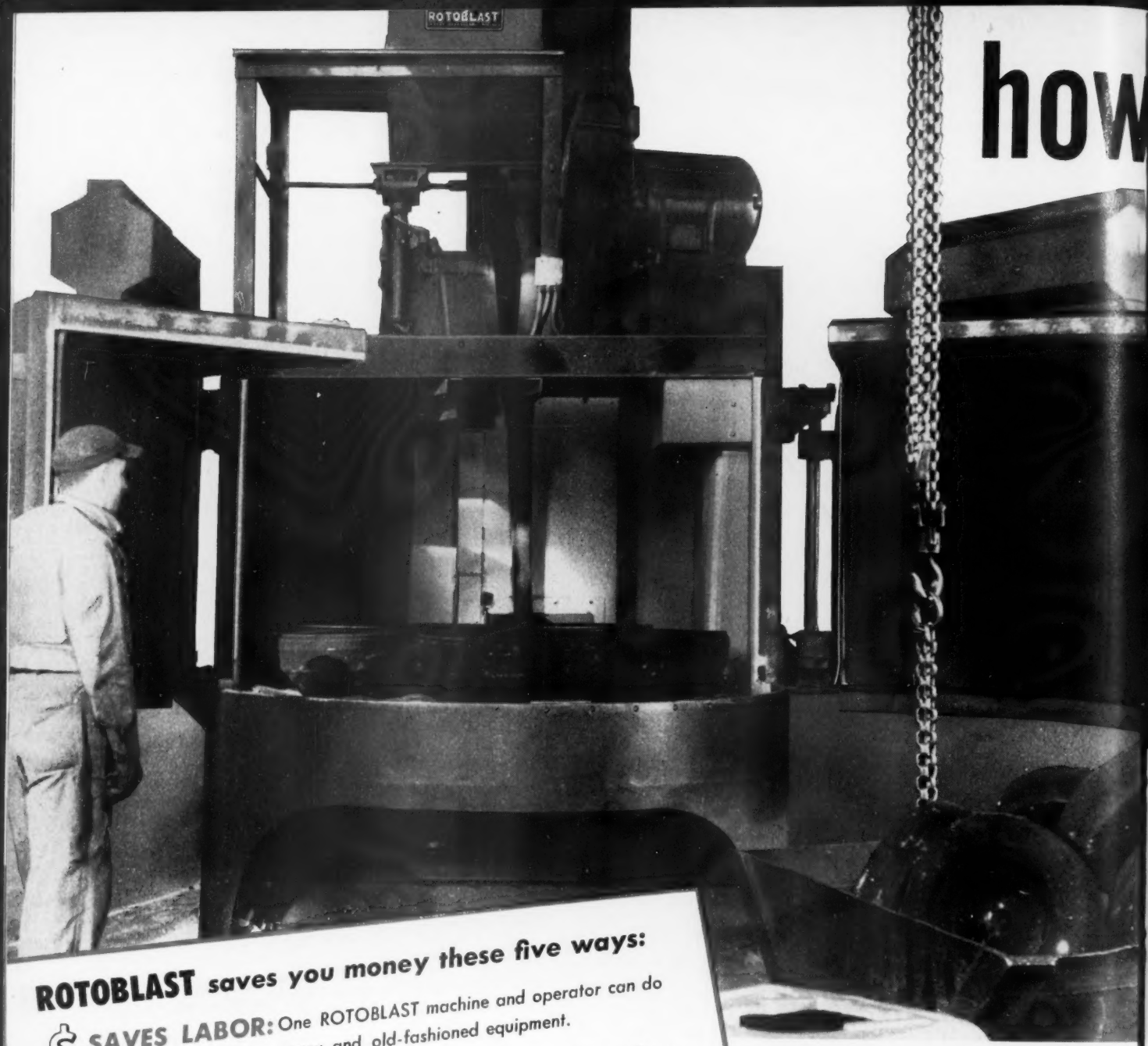

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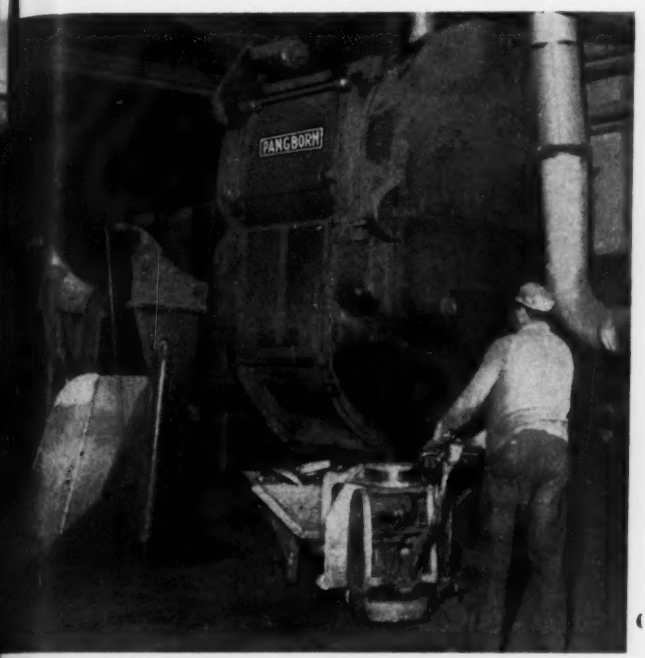

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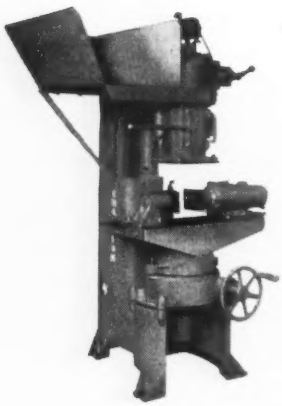

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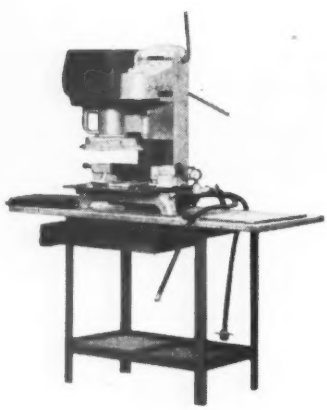

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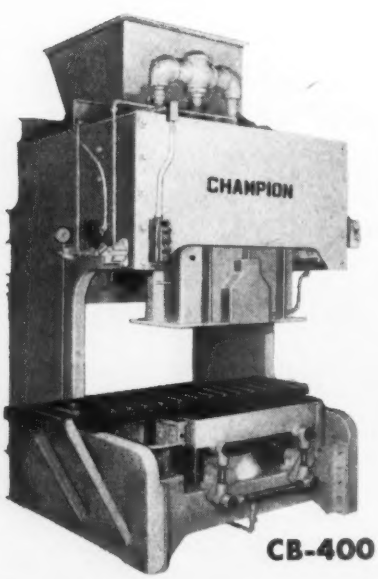
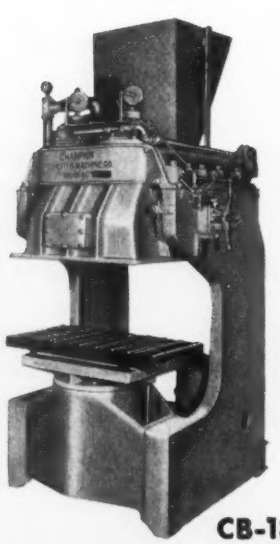


CB-400



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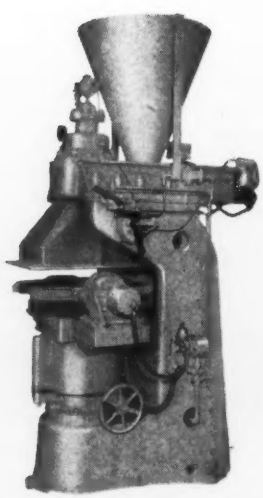

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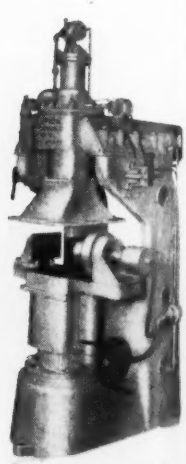

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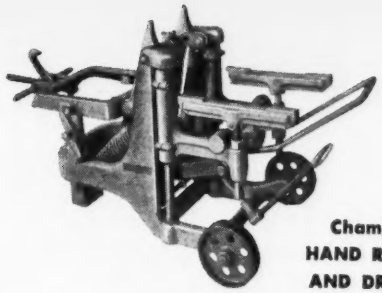

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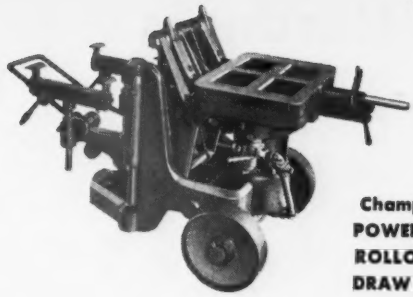

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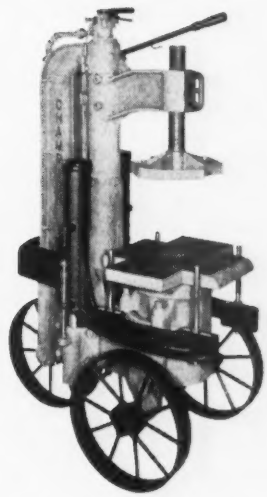

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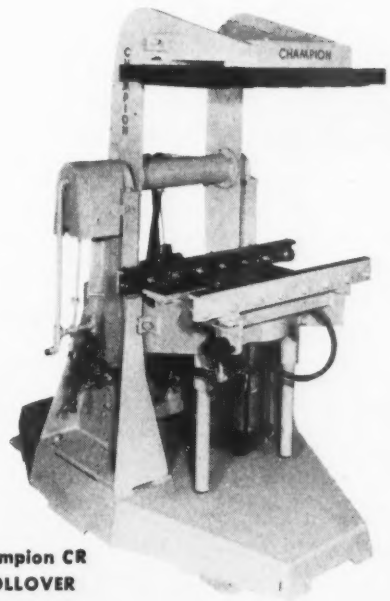

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A/B Westin & Backlund, 8 Liljeholmsvagen, Stockholm

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Bonvillain & Ronceray, Inc., Rue Paul Carle, Choisy Le-Roi, France

ITALY
Fratelli Musso, 56 Corso Bramante, Torina, Italy

ARGENTINA, URUGUAY
W. F. Guth Industrial Equipment & Furnace Co.
Avenida R.S. Penna 852, Buenos Aires R-26, Argentina

BRAZIL
W. F. Guth Foundry Engineering, Caixa Postal 1411, Sao Paulo

CHILE
Mauricio Hochschild & Cia. Ltd., Casilla 153 D, Santiago, Chile

Core Hardness

Every foundryman knows that the relative hardness condition of cores tells its tale in the casting. All the advantages of accurate core-hardness control can be obtained with this direct-reading, Gordon-Campbell Core Hardness Tester. The test results are dependable — and obtained easily in a few seconds. No special skill is required.

Write for full particulars.

OTHER Gordon & Campbell TESTING EQUIPMENT:

Combination Rammer-Compression Tester—Simple way to prepare specimens to determine compression strength.
Permtester—A foolproof method for determining sand permeability.
Transverse Test Core Maker—For preparing core specimens for transverse tests.
Transverse Core Tester—Rapidly determines transverse strength of dry sand cores.
Baking Oven—Electrically heated, dries sand samples, bakes core specimens.
Moisture Tester—A reliable method of measuring moisture content.
Sand Mixer—For thorough preparation of sample core-sand mixtures.
Sand Washer—The easy-to-use method to determine clay content of sand.

Each of these testing units was designed to conform with the recommendations of the Committee on Foundry Sand Research of the American Foundrymen's Society.

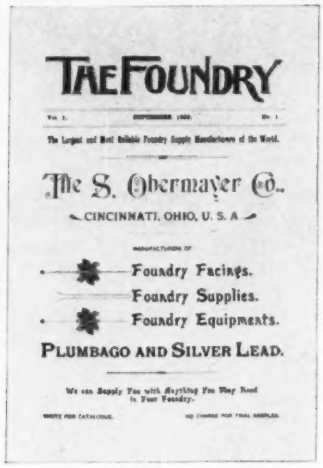
Complete information upon request.

GORDON SERVICE

CLAUD S. GORDON CO.
Manufacturers & Distributors
Metallurgical Testing Machines • Industrial Furnaces & Ovens • Temperature Control Instruments • Thermocouples & Accessories
Dept. 20 • 3000 South Wallace St., Chicago 16, Ill.
Dept. 20 • 2035 Hamilton Ave., Cleveland 14, Ohio

With the EDITORS

OVER many years, the various editors of FOUNDRY have spent considerable time poring over our back issues. Ed Bremer has a complete file of bound volumes in his office, starting with Vol. I, No. 1, published in September, 1892, and all of us find considerable pleasure in taking a look at how this important industry operated way back when.



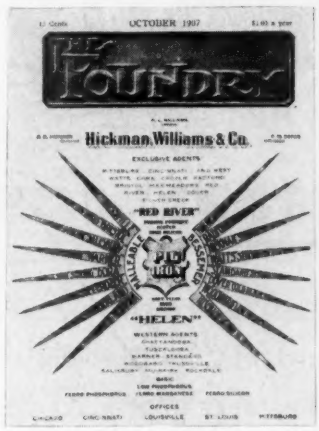
The first issue was small, 6⅝ x 9⅜ in. and with 36 pages including the cover

These studies generally are confined to the editorial or advertising pages, and little attention has been given to covers. Therefore the new pictorial type cover, which was started last month, created a bit of curiosity about covers of the past. So we went over to Ed's office, pulled down volumes until we had filled the top of his desk, and found a number of interesting facts about the covers through the years.

Left—Editorial cover with the Contents was used the fourth issue. *Right*—One of many variations which followed. Looks a little like General MacArthur on the left shank

The first cover, dated September, 1892 carried an advertisement of S. Obermayer Co., Chicago, and this advertisement appeared in the two succeeding issues. But the December, 1892 issue appeared with an editorial type cover, as is shown in one of the reproductions here, and it was not until September, 1907 that advertising returned to the cover. During that period, the cover was changed frequently, but the theme, "A Trade Journal Devoted to the Interests of the Whole Foundry Business," was

(*Concluded on page* 12)



A change in size and masthead accompanied the return of advertising in 1907. The boys of Hickman, Williams & Co. tell us that the "Helen" mentioned was a brand of pig iron. Many foundrymen would be interested in seeing more of Helen today

Sample of copy used in the twenties when *Foundry* was published twice a month

General Purpose

"FOUNDROMATIC" SHAKEOUTS

New SIMPLIFIED SHAKEOUT Ideal for Small Operations

THE NEW GENERAL PURPOSE *Foundromatic* shakeout now brings to the smaller foundry the proven basic advantages of the shakeout . . . higher production per square foot of foundry and per man, improved working conditions, and low maintenance. And this *Foundromatic* shakeout design, exclusively Allis-Chalmers, is field-proven!

The General Purpose shakeout is **versatile in installation!** It either can be installed permanently *or* it can be mounted on a portable base. It can be installed with the deck horizontal for general shakeout duty or with a slope so that castings or flasks will discharge.

The General Purpose shakeout is **versatile in application!** *Foundromatic* shakeouts are suitable for steel, gray iron and non-ferrous foundry mold shakeout *and casting core knockout applications.*

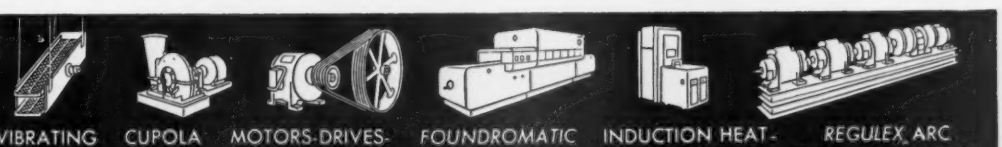
The General Purpose shakeout is **designed for long service!** Weight of body and load is supported and isolated from the foundation by rubber mountings for elimination of virtually all vibration transmission. Centrifugal force alone produces the vibration in a *two bearing* mechanism. The vibrating force is produced by a shaft machined eccentrically between the bearings eliminating balance wheels and requiring only *one* dust seal. And the drive is true running with the motor isolated from the operating amplitude.

The General Purpose *Foundromatic* shakeout is being manufactured in five sizes, ranging in capacity from 2000 to 5000 lb. Call your nearby A-C sales office for information, or write to Allis-Chalmers, Milwaukee 1, Wis. for Bulletin 07B7532. A-3265

ALLIS-CHALMERS

Foundromatic and *Regulex* are Allis-Chalmers trademarks.

Foundry Equipment for Bigger Output-Better Working Conditions!



VIBRATING SCREENS | CUPOLA BLOWERS | MOTORS-DRIVES-CONTROL | FOUNDROMATIC CORE DRYER | INDUCTION HEATING & MELTING | REGULEX ARC FURNACE CONTROL

More production . . . ground faster. That's why the foreman is so well pleased with himself . . . and with the rugged, stand-up performance of Simonds Abrasive Company resinoid bonded grinding wheels . . . real money savers on production operations . . . and part of a complete line including grinding wheels, mounted wheels and points, segments and abrasive grains.

Bulletin ESA 62 describes Simonds Abrasive Company resinoid bonded wheels. Let's send it to you, together with full information on our complete line and the name of your nearest Simonds distributor. Write for them today.

SIMONDS ABRASIVE CO.
grinding wheels

SIMONDS ABRASIVE COMPANY, PHILADELPHIA 37, PA. DISTRIBUTORS IN PRINCIPAL CITIES

Division of Simonds Saw and Steel Co., Fitchburg, Mass. Other Simonds Companies: Simonds Steel Mills, Lockport, N. Y., Simonds Canada Saw Co., Ltd., Montreal, Que. and Simonds Canada Abrasive Co., Ltd., Arvida, Que.

(*Concluded from page* 10)

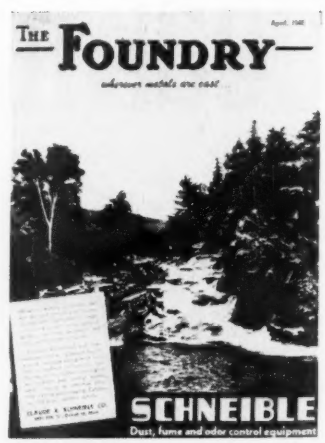
carried on nearly every new design. Incidentally, this statement was taken from the editorial in the first issue, written by John A. Penton, and has been the publishing philosophy of

This reproduction does not do justice to the beautiful color treatment on this advertisement, but it does show a new masthead

every editor who has served the paper, and the foundry industry.

When advertisting was resumed in 1907, S. Obermayer Co. appeared first; this was followed by the Hickman, Williams & Co. cover which is included in the accompanying cover reproductions.

The depression of the thirties took

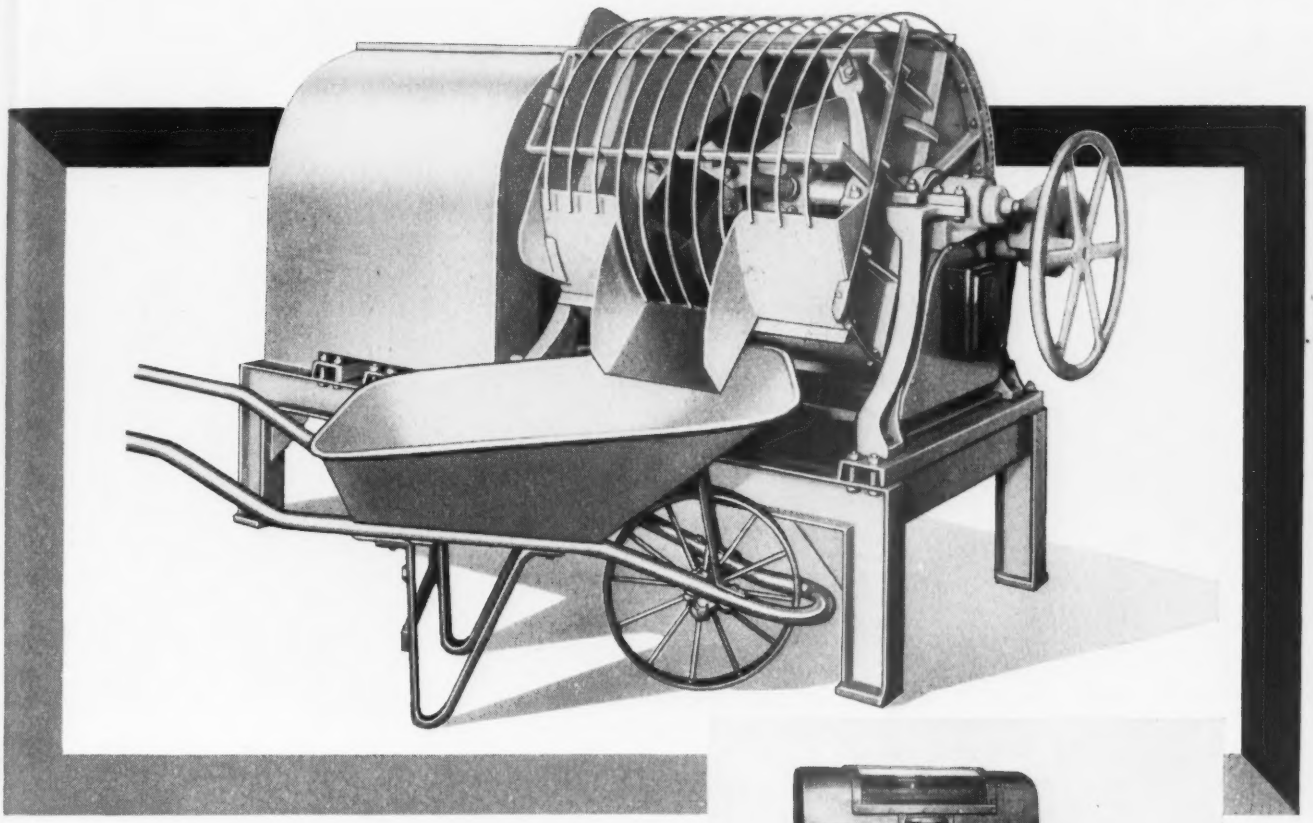


Postwar design, with the masthead changed. Excellent copy, good color treatment and an overall ad provided a pleasing message

advertising off the cover in June, 1932. Return of advertisements in November, 1935 had Ohio Ferro-Alloys Corp., Canton, O., on the first cover.

Now the cycle starts over. Our first editorial cover in January brought numerous interesting comments, and we hope you will like the presentation on this issue. If nothing else, it gives the editors something else to dream about.—F. G. S.

BLYSTONE MIXERS

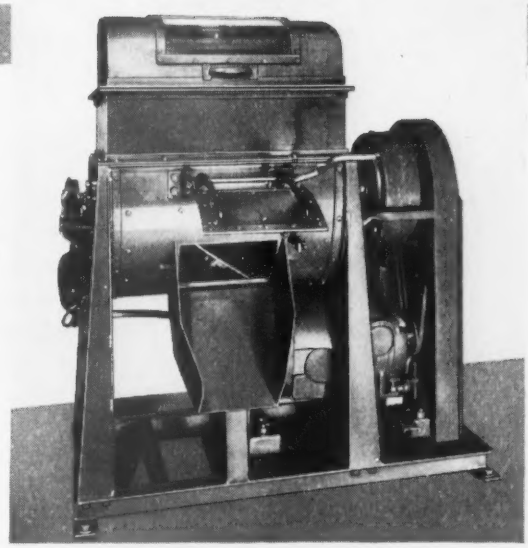


for low-cost CORE SAND MIXING

Over 35 years of developing Blystone paddle type mixers has perfected their use for foundry core sand mixing. With your requirements in mind, Blystone Mixers have been constantly improved with features that assure *Low Initial Cost . . . Low Mix Cost . . . Thorough Mix . . . Easy Operation . . . Sturdy Construction.*

The exclusive Blystone mixing system shovels, stirs and trowels thoroughly, developing the full value of oils or other binders, and producing the correct porosity for cores that means perfect castings.

Built in capacities from 3 to 14 cu. ft., Blystone Mixers are the low cost answer to your core sand mixing problems. Write for further details.



HERE IS THE LATEST MODEL . . .
This newly designed Blystone incorporates many exclusive features, including a revolutionary type of drive arrangement that permits increased efficiency and simple, easy operation and maintenance. Unit has 3 cu. ft. capacity, utilizes 3 hp motor.

BLYSTONE DIVISION STANDARD SAND & MACHINE CO.
549 W. Washington Blvd., Chicago 6

Today all metals are Precious!

As if you didn't know!

But did you know that the Croning Process for making sand molds and cores is conserving metal—both ferrous and non-ferrous—for vital production in a growing number of foundries?

The process conserves metal because pieces can be cast to close dimensions. It conserves metal because it minimizes rejects of castings—cuts down the scrap pile. It conserves metal by greatly reducing the amount of machining required, often just a finish cut being needed.

Because the molds and cores can be stored for long periods of time, it promotes efficiency by permitting you to build a mold inventory rather than a castings inventory—making it possible for you to schedule your mold making to match anticipated quotas of metal and demands for production.

If you have not yet looked into this economical process which makes it necessary to handle only 10 per cent of the sand normally handled, by all means do it now. Send for your free copy of our 16-page illustrated booklet, "BAKELITE Phenolic Resins for the Croning Process."

It contains helpful information on BAKELITE Resin Binders, as well as a special BAKELITE wetting agent and a parting agent developed for the process by BAKELITE engineers. Reference is made also to selection of sands, pattern preparation and core making. Simply fill out and mail the coupon below.

Dept. BP-29, BAKELITE DIVISION,
Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N.Y.

Please mail at once my free copy of the booklet, "BAKELITE Phenolic Resins for the Croning Process."

Name _____ *Title* _____

Company _____

Street _____

City _____ *State* _____

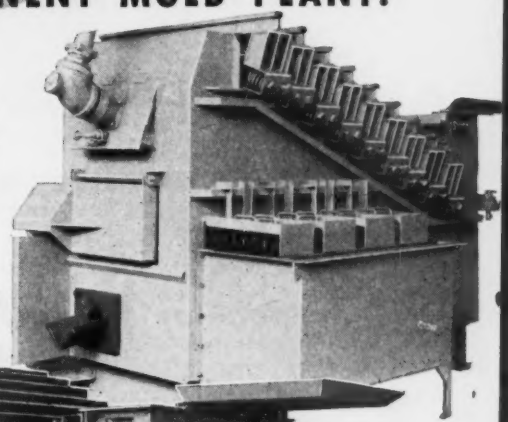
Bakelite
TRADE-MARK
PHENOLIC
BONDING RESINS
TRADE MARK

BAKELITE DIVISION
Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N.Y.

STROMAN FURNACES

FOR *Every* ALUMINUM MELTING JOB IN *Any* FOUNDRY, DIE CASTING OR PERMANENT MOLD PLANT!

Stroman builds the most efficient, fastest melting and most economical furnaces available. One of these famous four will handle your every melting requirement at great savings.

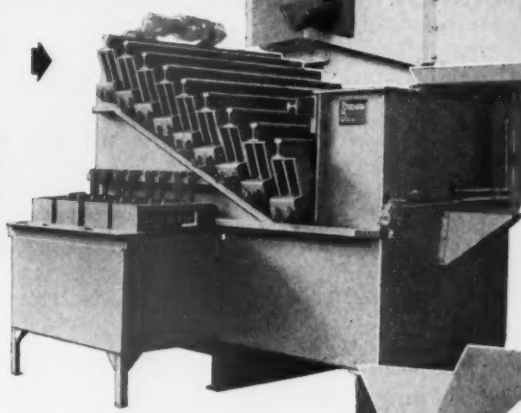


FRONT VIEW showing dip-out box, tapping spout, slagging and cleanout door.

STROMAN TYPE "MC" ALUMINUM DIP-OUT REVERBERATORY FURNACE

Bath capacity from 500 to 10,000 lbs. Aluminum

A combination of breakdown and holding furnaces makes this the most economical furnace ever designed for aluminum melting. It can be used for melting, holding, alloying, fluxing, for either casting or producing ingots. Cold metal does not reach the molten bath. Hot metal is always available for dipping. No iron pots or crucibles to buy. Oil, gas or combination oil-gas fire. Complete automatic controls are available if desired.



REAR VIEW showing charging hopper and special pneumatic charger.

STROMAN ECONOMELT REVERBERATORY FURNACES

Featuring the famous Stationary Lip Pour which assures a constant pouring arc and eliminates the necessity of moving the ladle at any time during the pour. The Economelt is without a doubt one of the finest reverberatory furnaces ever built. Melting speeds for Aluminum, Brass, Bronze, or Grey Iron are unsurpassed. All metal is preheated and melted in suspension in the throat of the hopper. This furnace is showing upwards of 40% savings in fuel costs. Oil, Gas or Combination Oil-Gas Fire. Charging Hoist and Furnace tilting are operated hydraulically. Hydraulic systems are furnished as complete units including operating valves, etc. Capacity in Aluminum up to 10,000 lbs. total bath. Write for Bulletin No. 635 for complete information.

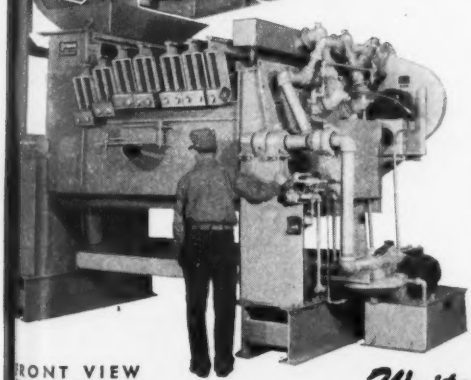
FRONT VIEW from charging end showing a Stroman Skip Hoist.

FRONT VIEW showing dipping end.

STROMAN TYPE "DS" REVERBERATORY FURNACE FOR MELTING ALUMINUM

300 and 500 lbs. bath capacities.

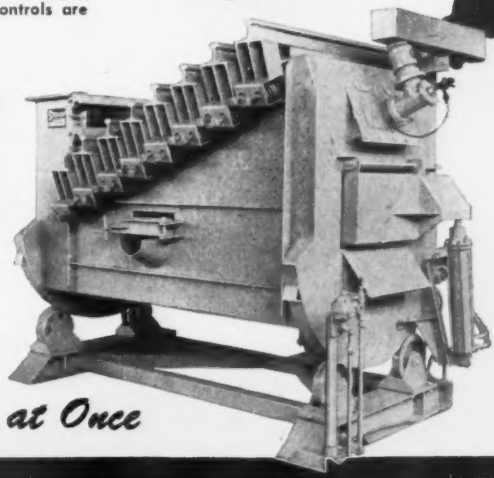
The "DS" Furnace provides a complete melting unit for each Die Casting Machine or Small Permanent Molds. It is a small compact unit that may be easily moved to any desired position in the plant. Eliminates the necessity of having both breakdown and holding furnaces. Saves over 50% in fuel costs over any other type. Ingots and returns are melted where they are cast. There is no handling of hot metal except to the die or mold. Metal is melted in a reducing atmosphere and is free from porosity with little or no dross. Complete automatic controls are available if desired.



FRONT VIEW FROM BURNER END.

STROMAN TYPE "SW" ECONOMELT REVERBERATORY FURNACE

Same as Economelt described above except that it is tilted by an air ram, and does not incorporate Stationary Lip Pour. It is excellent as a breakdown furnace for ingot and returns, in die or sand casting and permanent mold plants. Suitable for re-alloying returns or running back machine shop scrap. A large opening is provided below burner equipment to facilitate such operations as drossing, fluxing, alloying, or puddling back light scrap or returns.



Write for Complete Information at Once

STROMAN FURNACE & ENGINEERING CO.

DIVISION OF

THE PETERSEN OVEN CO. • 9900 FRANKLIN AVE. • FRANKLIN PARK, ILL.

ARE YOU READY f

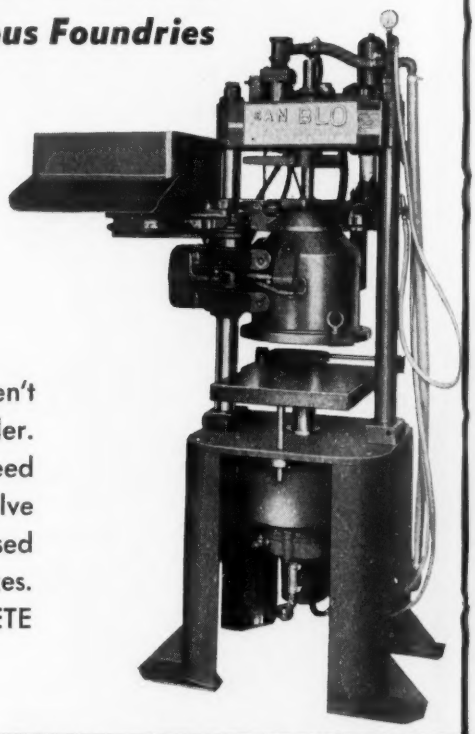
Your foundry is going to need more equipment tom

Federal has a complete line of machines . . . for P

SAN-BLO ALL-PURPOSE SAND BLOWER

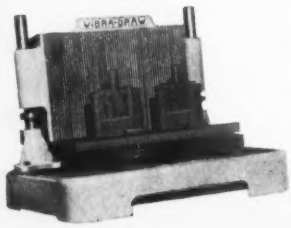
for Jobbing, Production, Iron, Steel and Non-Ferrous Foundries

1. **Blows any sand that can be hand-rammed**
2. **Blows high-strength, high-moisture sand**
3. **Blows cores weighing up to 40 lbs. each**
4. **Easy to operate—skilled labor unnecessary**
5. **No time lost changing from one box to another**



The new SAN-BLO never stands idle because core mixtures aren't right—it blows any sand you can hand-ram, regardless of binder. No worries either, about experienced core makers—you don't need them. Only one adjustment to position blow head. A single valve controls clamping and blowing. One blow plate blows all closed boxes, and with universal vent plate attachment, all open boxes. WRITE FOR NEW 8 PAGE BULLETIN No. CB-2 FOR COMPLETE INFORMATION.

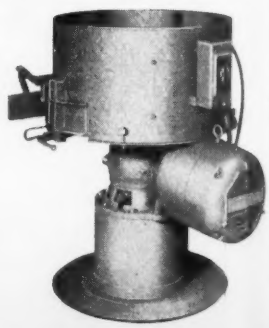
VIBRA-DRAW Core Drawing Machine



The ideal core drawing machine for either apprentice or experienced core makers. Operation is exceptionally easy and fast. Simply place core box against vibrating head and lift box—a perfect core every draw.

WHIRLMIX Sand Mixer

The first and only mixer with flexible, whirling, rubbing arms. Produces fluffy, aerated, thoroughly mixed sand without overheating, or crushing sand grains. Small, compact, easily-moved—yet a big producer, for it mixes 4,000 lbs. of sand per hour.



Federal Foundry Equipment

for Defense Orders?

to meet the big demand for new, heavier castings.

for PROMPT DELIVERY. Don't wait! Order now!

CLIMAX WIRE STRAIGHTENER

for reclaiming used core rods and wires

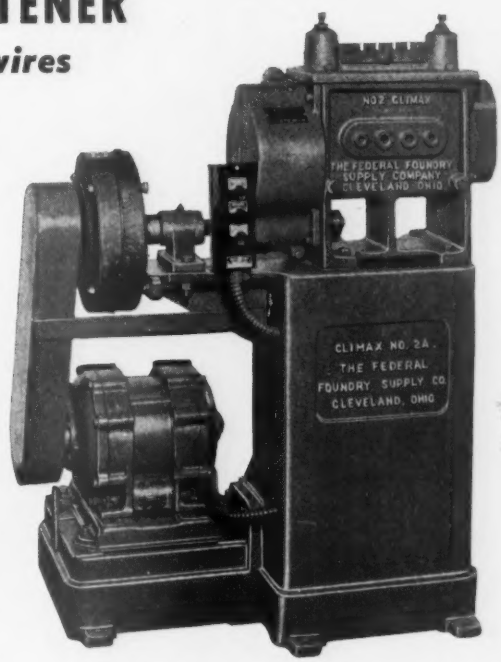
Now with wire hard to get, it's more important than ever before for foundries to straighten and re-use wires and rods. The CLIMAX Wire Straightener is the ideal machine for this important job.

1. Straightens random lengths of wires and rods
2. Can be operated efficiently by unskilled labor
3. Operation is safe, simple and fool-proof
4. A wide variety of models is available

Model 2 handles 4 wire sizes from 1/16" to 1/4". Model 2 1/2, 4 sizes, from 3/16" to 1/2". Model 3, 5 sizes from 1/4" to 3/4". Each model can be furnished with (1) extended shaft for your own drive, (2) with speed reduction unit for your motor, or (3) completely motorized.

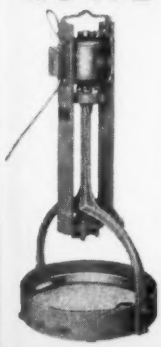
"An Old Friend"

The CLIMAX Wire Straightener has been an old friend in many foundries. Picture at left shows one of the models in use more than thirty years ago. CLIMAX machines have been improved and modernized to guarantee efficient operation.


NO. 2 CLIMAX
THE FEDERAL FOUNDRY SUPPLY COMPANY CLEVELAND, OHIO
CLIMAX NO. 2A
THE FEDERAL FOUNDRY SUPPLY CO.
CLEVELAND, OHIO

Model 2A—Motorized

LOWE Electric Sifter



The LOWE Electric Sifter features greater screening area, enclosed ball bearing motor, more shoveling room, rugged construction and trouble-free operation. It will save time and money for you, through faster sifting and better sand conditioning. Write for descriptive circular and prices.

SHUR-SPOT Sprues

For use on squeezer-made molds. SHUR-SPOT squeezes down with the sand. When squeezer board is removed, SHUR-SPOT pops up to be lifted out. The result is a fully completed and properly located pouring sprue, requiring no finishing. Write for complete information and prices.

THE FEDERAL FOUNDRY SUPPLY COMPANY

4600 East 71st Street • Cleveland 5, Ohio

Sales Offices: CHICAGO • DETROIT • MILWAUKEE • NEW YORK • CHATTANOOGA • RICHMOND, VA. • LOS ANGELES

with MANHATTAN ABRASIVE WHEELS

Fast metal removal for sustained periods with a wheel that doesn't load or glaze is the foundryman's ideal. Manhattan Abrasive Wheel Engineers achieve this ideal by custom tailoring wheels for *your* work. Whatever the metal removal problem may be, Manhattan's experience comes to your aid in reducing your costs.

MANHATTAN CUT-OFF WHEELS — Manhattan Cut-Off Wheels make cool, quick cuts . . . and many more per wheel. Here again, Manhattan follows its policy of custom tailoring the type and size of wheel to solve any perplexing cut-off problem. Manhattan Cut-Off Wheels constantly achieve new records for number of cuts per wheel . . . with uniformly high quality of cut. Manhattan Cut-Off Wheels are the "pay-off" wheels for you.

Exclusive Manhattan developments and constant laboratory tests of both Rubber and Resinoid Bonding insure wheels that last longer and produce better results in less time. Thus, your costs are lowered 3 ways.

Did you see the demonstration of the new MANHATTAN Reinforced Foundry Cut-Off Wheel at the National Metal Exposition in Chicago?

ABRASIVE WHEEL DEPARTMENT

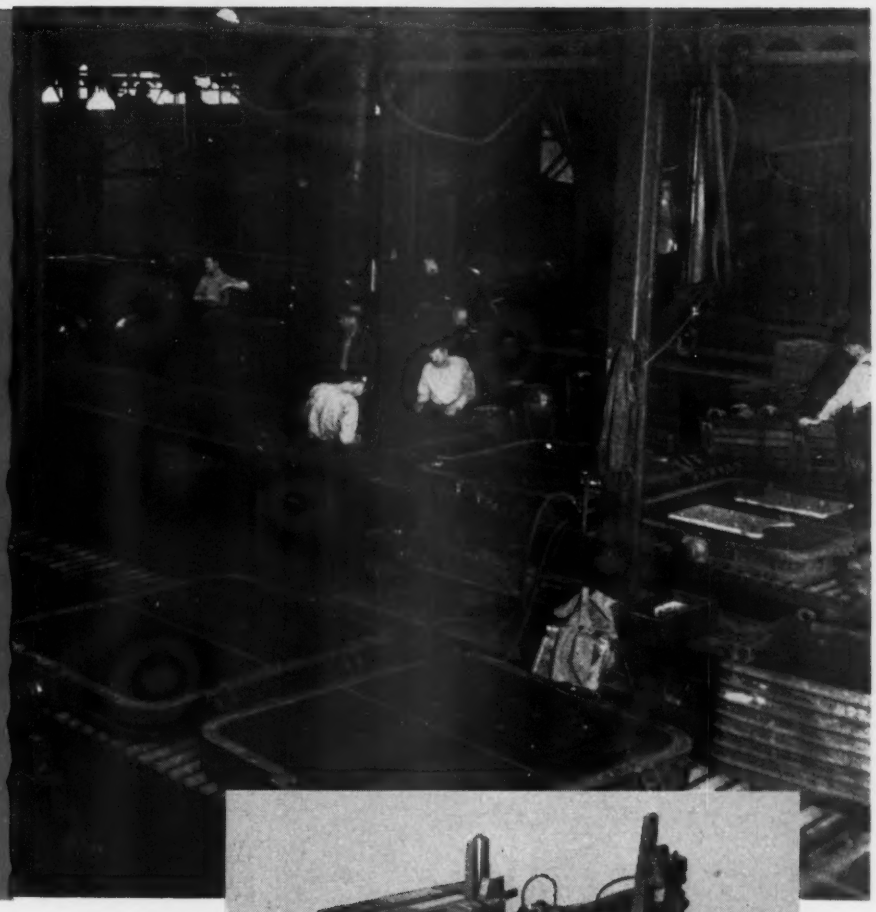
MANHATTAN RUBBER DIVISION

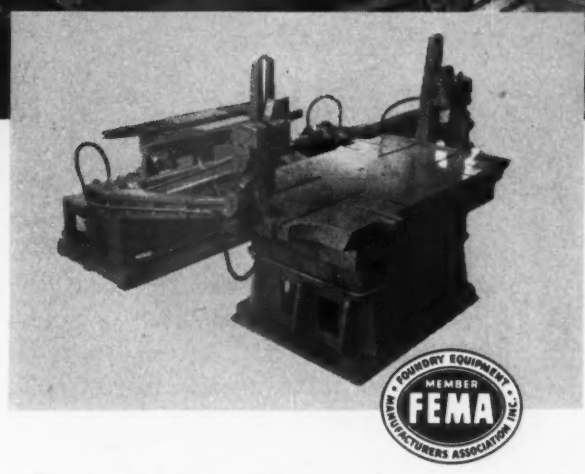
PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC., Manufacturers of Brake Linings • Brake Blocks • Clutch Facings • Radiator Hose • Fan Belts • Mechanical Rubber Products • Rubber Covered Equipment • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

This Foundry is a good place to work

Crane Company,
Chattanooga, Tenn.





THIS company's Chattanooga division manufactures cast iron heating boilers, cast iron porcelain enamelware and cast iron radiation products.

It is a good place to work because Crane management brings a progressive attitude to bear on the problems of production...with the result that up-to-date safety measures are taken and good housekeeping programs are constantly being reviewed.

All efforts have been made to mechanize the plant to the fullest extent. Sand handling, conveying, and shipping equipment are the latest type.

2100 people are employed in this modern plant which covers 44 acres of land and has 495,000 square feet of factory space.

Herman Molding Machines have been used in this plant for many years, to help make it a good place to work. Some of the older type machines are still operating alongside newer types.

Features of these machines, and *all* Hermans, include automatic lubrication; simplicity of operation, with one rotary valve handling the complete cycle of operation; no power required for the roll-back operation.

Best of all, they've made their way by the way they're made.

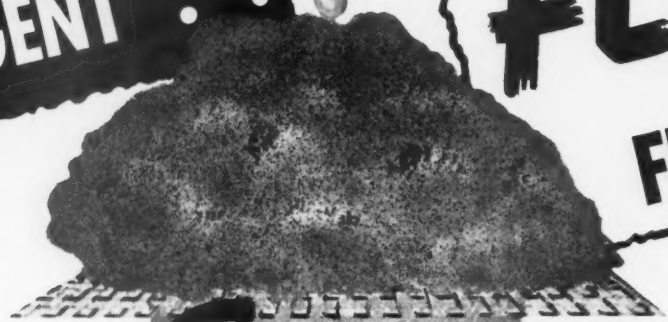
Herman MOLDING MACHINES

HERMAN PNEUMATIC MACHINE CO., UNION BANK BUILDING, PITTSBURGH, PA.

DELTA 96·B SAND RELEASE AGENT . . .

Another Foundry "First"...by DELTA

MAKES SAND FLOW FREELY



Easy AND *Economical* TO USE

By adding only 8 ounces or less of DELTA 96•B SAND RELEASE AGENT, per ton, to your core or molding sand mixes, your sands will flow freely . . . be easier to handle . . . easier to use. They will not stick to core boxes or patterns no matter how intricate they may be.

DELTA 96•B SAND RELEASE AGENT is the result of persistent research by DELTA Laboratories devoted to the discovery and development of a lubricant-dispersant for use in sand mixes. DELTA 96•B is a liquid which provides properties hitherto unknown in sand conditioning materials. It is completely volatile at elevated temperatures and does not contaminate the sand.

READ WHAT USERS SAY ABOUT DELTA 96•B SAND RELEASE AGENT

". . . . with the addition of 8 ozs. of Delta 96•B we are now able to blow cores we otherwise couldn't blow."

". . . . Delta 96•B gives the sand improved flowability. Our sand now works much more freely and leaves the core boxes clean."

". . . . and the trouble we had with sand sticking in the hopper, in the chute and on the conveyor has been eliminated with the use of Delta 96•B."

•

Prove it yourself in your own foundry. Ask for a test sample. No cost or obligation. You will also receive instructions for use. Write today.

DELTA OIL PRODUCTS CO.

Manufacturers of Scientifically Controlled Foundry Products

MILWAUKEE 9, WISCONSIN

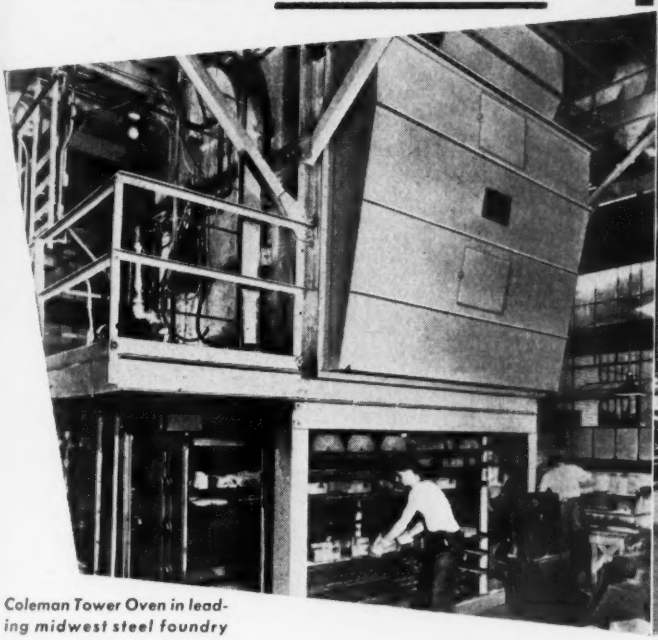
for maximum production

COLEMAN

for better work conditions

TOWER* OVENS

for lowest operating cost



Coleman Tower Oven in leading midwest steel foundry

Coleman Tower Oven baking cylinder head cores in automotive foundry

By installing Coleman Tower Ovens, foundries everywhere have increased production and improved coreroom working conditions, for these reasons:

PATENTED OPEN CENTER: Provides close, efficient grouping of coremakers around the oven. The exclusive 3-way loading feature increases accessibility 300% over ordinary vertical oven designs. Cuts carry time to a minimum — users report increased coremaker productivity of over 50%.

RECUPERATIVE COOLING SYSTEM: Cores are "smoked off" and cooled before they reach the unloading station, making for better working conditions. The heat recovered from the cores is used over again, resulting in large fuel savings.

AMAZING FLOOR SAVING: Baking is done overhead, providing larger core-baking capacity in 25% of the floor space required by batch type ovens. Indirect labor savings up to 75% are secured by the elimination of racks, trucks, aisle ways and inefficient congested work areas.

PERFECT BAKING: The Coleman heating system produces perfectly baked cores with unusual speed. No rejects...no make-overs...no defective castings due to improper core baking—further increasing production.

*Trademark Reg. U.S. Pat. Off.

For further information, write today for Bulletin 48

A COMPLETE RANGE OF TYPES:
COLEMAN OVENS are built in a complete range of sizes and capacities for every core-baking and mold drying requirement: Tower Ovens, Horizontal Conveyor Ovens, Car-Type Ovens, Transrack Ovens, Rolling Drawer Ovens, Portable Core Ovens, Portable Mold Dryers, etc.

THE FOUNDRY EQUIPMENT COMPANY

1831 COLUMBUS ROAD — CLEVELAND 13, OHIO

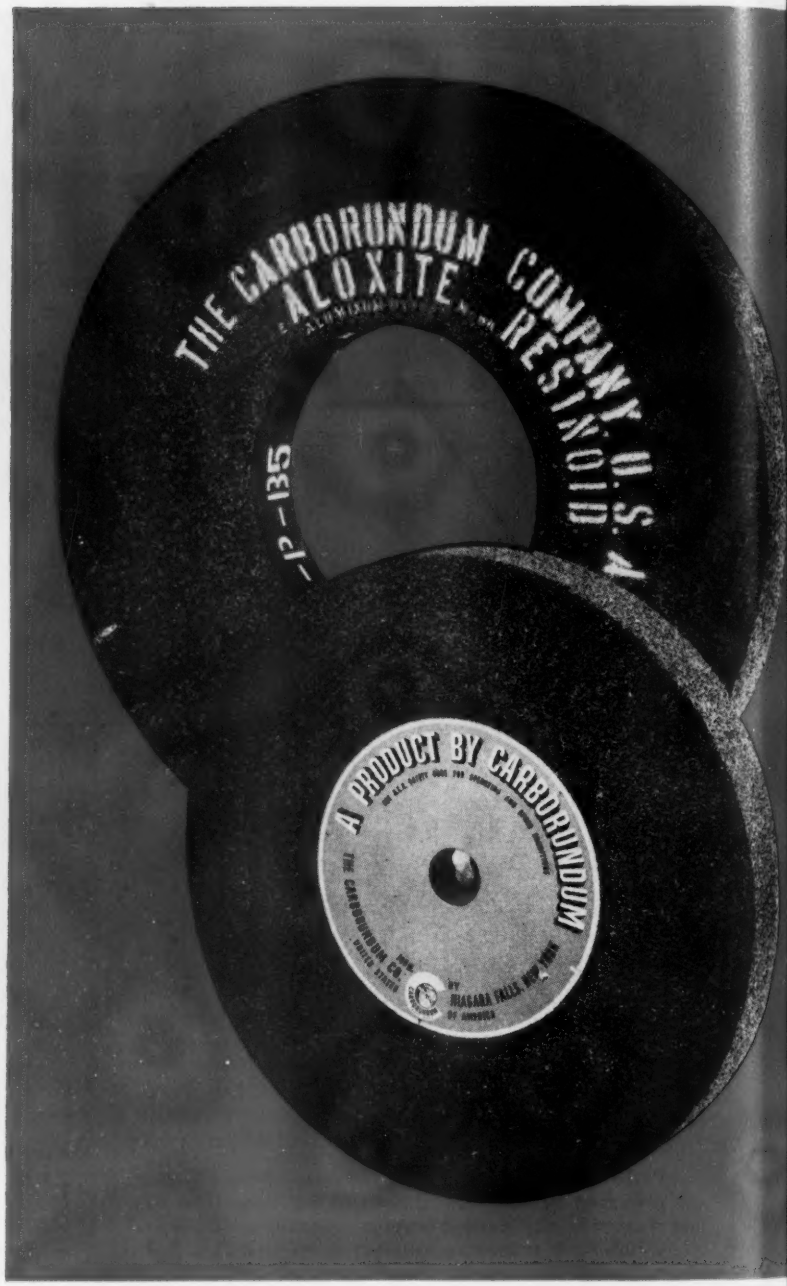
MEMBER FEMA

WORLD'S OLDEST AND LARGEST FOUNDRY OVEN SPECIALISTS

It takes the RIGH

OUR NEW and improved V10 Bond Wheel is especially designed for use on low-speed equipment for grinding high tensile strength materials. It is a revolutionary modification of an existing product.

TYPICAL OF NEW developments at CARBORUNDUM are improved B5 and B7N resinoid bond aluminum oxide and silicon carbide wheels for high-speed operations. They provide higher productivity with added safety and lessen operator fatigue.

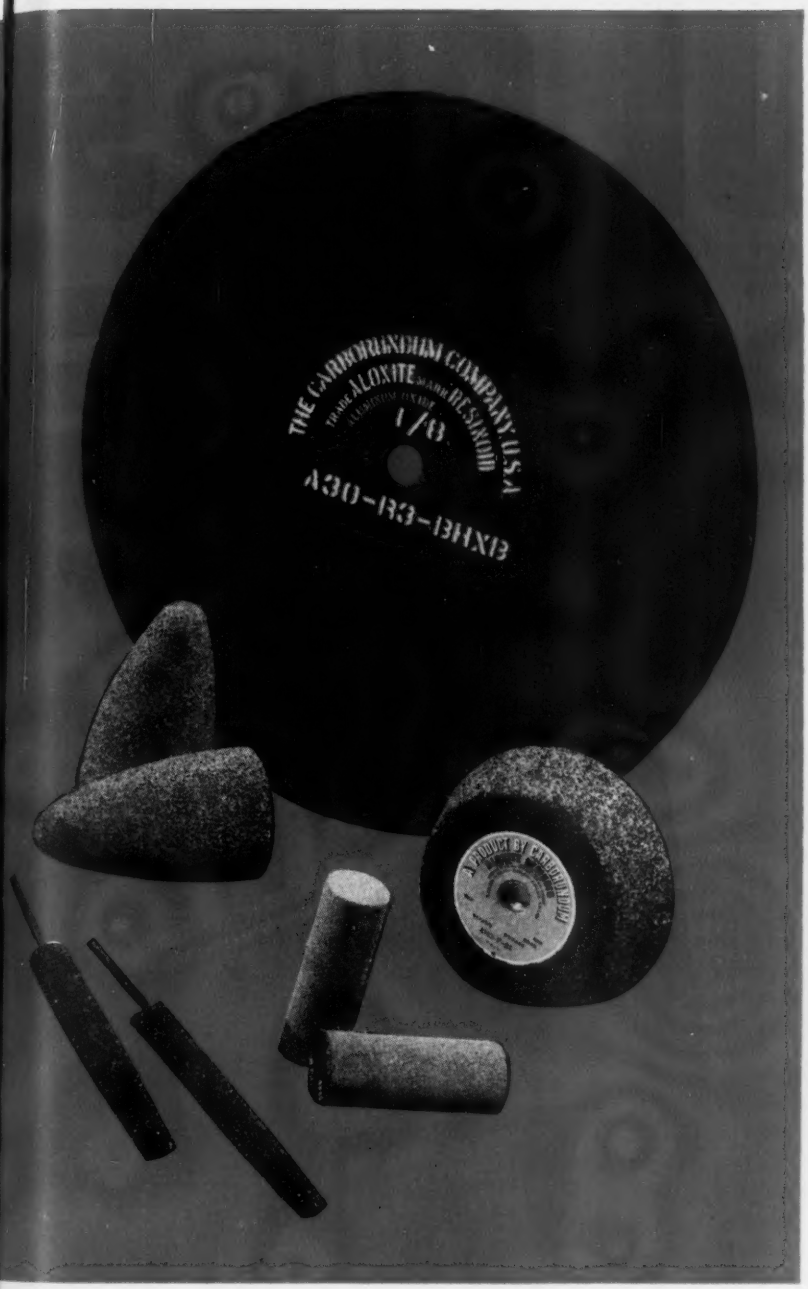


Only **CARBO**

TRAD

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Compa
Niagara Falls, New York.

Abrasive to do the job RIGHT



With production schedules stepped-up and costs on the rise, using the *right* abrasive becomes even more important in boosting output while effecting substantial savings.

CARBORUNDUM'S complete line of bonded abrasives includes the right product for every job. It covers the full range of high and low speed wheels, disc wheels, mounted points, rubs and other special abrasives. To meet changing job requirements, continual improvements and developments are made in both products and their application. That's why, when you call in CARBORUNDUM, you are assured of the *right* abrasive for the job...the most efficient...the most economical...impartially recommended.

ANOTHER recent development is the new VD Bond series of vitrified wheels ...establishing new records in grinding gray iron, hard malleables, semi-steel and non-ferrous metals.

RUNDUM

A D M A R K

makes ALL Abrasive Products...to give you the proper ONE

The perfect green bond...

MOGUL CUTS DRYING TIME

LARGEST SELLER IN THE FIELD

MOGUL makes smoother cores

MOGUL cuts down discards

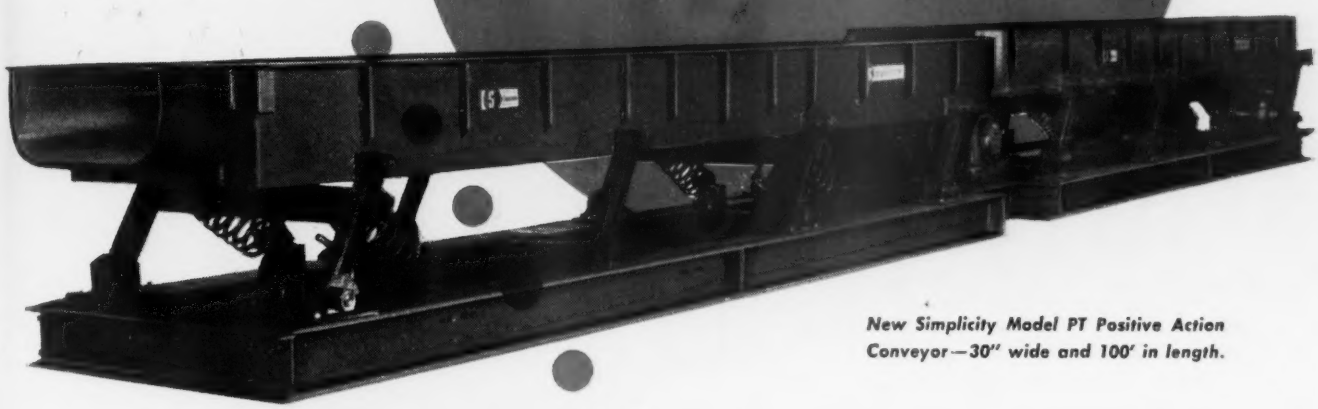
Full technical service, without obligation, is available to show how you can profit from the use of MOGUL Cereal Binder in your production.

Write Technical Sales Department

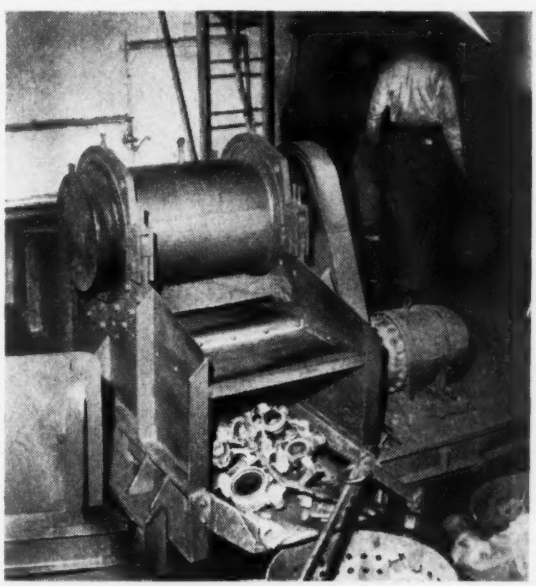
CORN PRODUCTS
REFINING COMPANY
17 Battery Place • New York 4, New York

— the preferred dry bond for cores

Simplicity conveyors cut the "high cost of handling" hot sand and castings...



New Simplicity Model PT Positive Action Conveyor—30" wide and 100' in length.



30" x 14' Simplicity Os-A-Veyor Type Conveyor handling hot castings at big automotive production foundry.

If you're spending too much money on maintenance and equipment repairs for handling hot sand and abrasive castings, it's time to cut costs with either a Simplicity Os-A-Veyor (Oscillating Type Conveyor) or a Model PT Positive Action Conveyor. Simplicity Conveyors are ruggedly built for tough foundry duty. Simple power units and operating mechanism mean *easy servicing and low maintenance costs* under the roughest operating conditions.

Model PT conveyors, built in lengths of 100', can be installed in multiples to meet any level-operation casting or sand handling requirement. Os-A-Veyor types, available in lengths to 30' and widths from 12" to 6', will operate on incline with capacity governed by depth of bed. Simplicity Conveyors give positive rate of feed and are ideally suited for handling hot, abrasive materials *without damage.* You can cut your high cost of handling hot sand and castings in your foundry with Simplicity Conveyors. *A Simplicity engineer will be glad to give you the full story.* Write, wire or phone us today.

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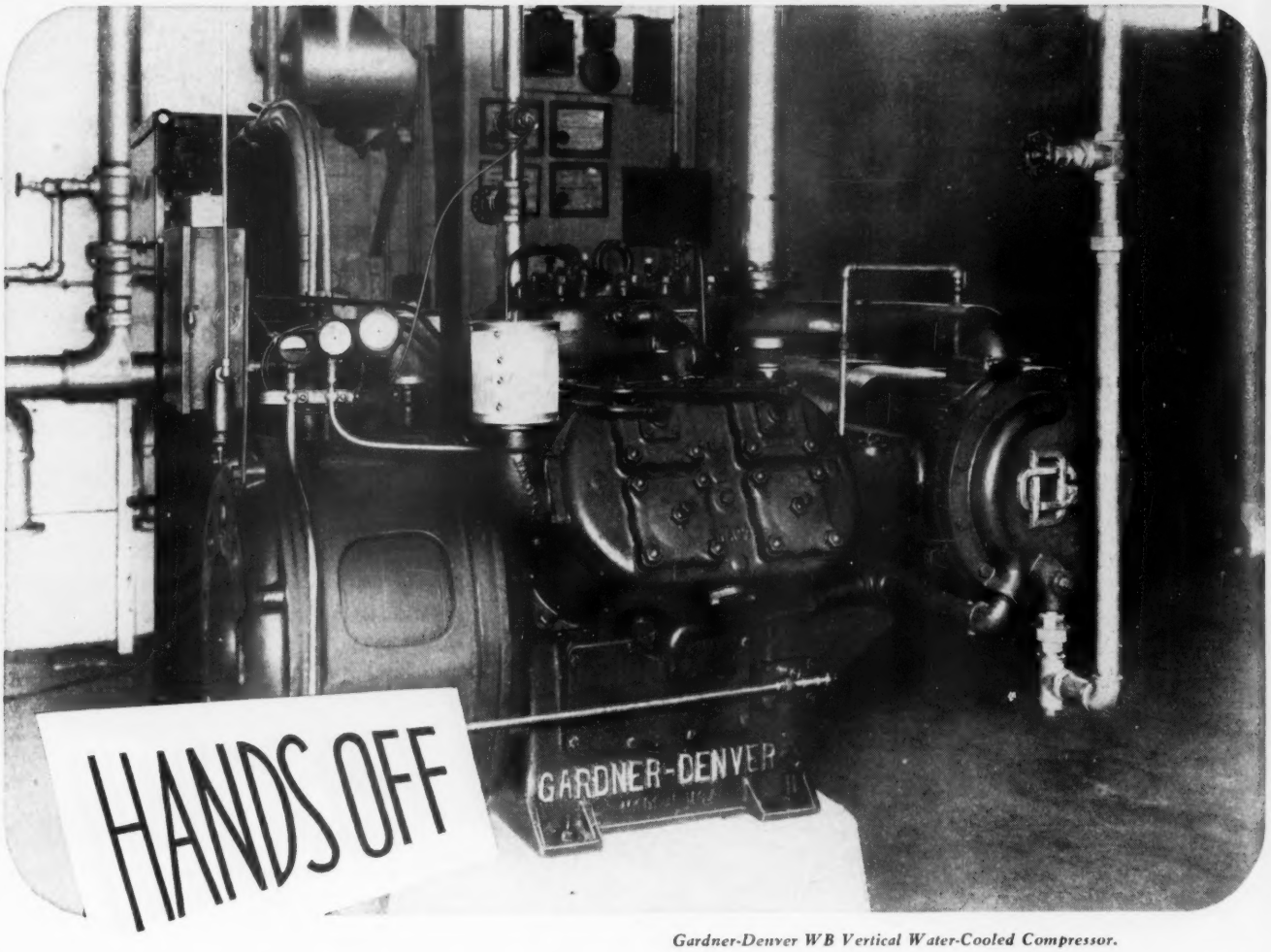
- **Sales Representatives In All Part Of The U.S.A.**
- **For Canada:** Canadian Bridge Engineering Company, Ltd., Walkerville, Ontario
- **For Export:** Brown & Sites, 90 Church Street, New York 7, N. Y.

Simplicity
TRADE MARK REGISTERED

ENGINEERING CO., DURAND, MICHIGAN



Gardner-Denver WB Vertical Water-Cooled Compressor.

"That sign's been up seven years already!"

A Gardner-Denver WB Compressor like this was installed in a midwestern plant seven years ago. It has never been touched since—except to change the oil and take up on the water pump packing. The valves have never been examined—even though the compressor saw 24-hour service much of the time.

Your maintenance men can keep "hands off," too, when you choose a Gardner-Denver WB Air Compressor. And a WB saves space as well as maintenance dollars—gives you big air capacity and high efficiency from a small corner of your plant.

Gardner-Denver WB Compressors are available with water tube intercooler, as shown, or with self-contained radiator intercooler for use where good cooling water is scarce. Send today for bulletin WB-10.

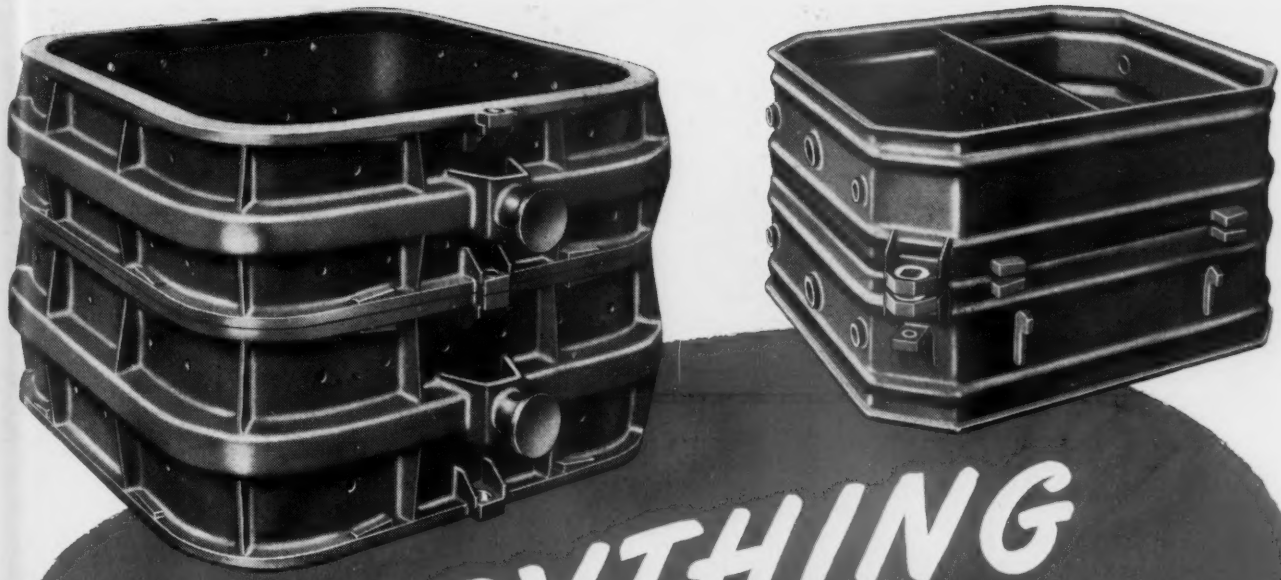
SINCE 1859

GARDNER-DENVER

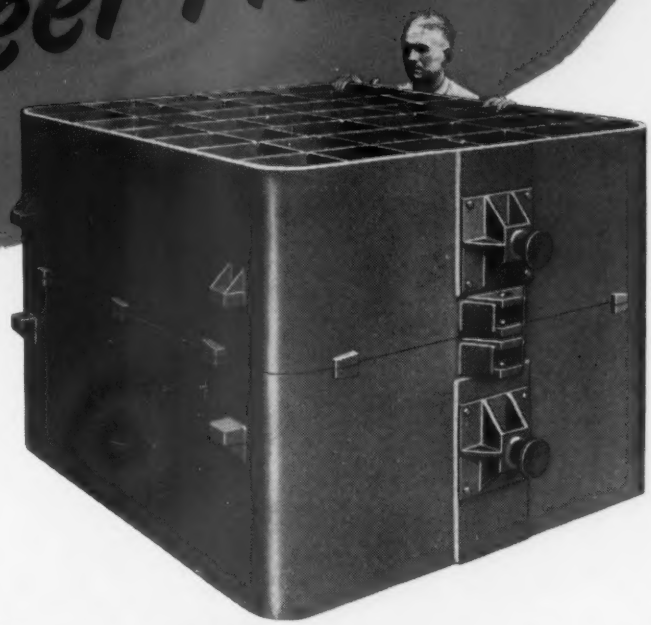
Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada), Ltd., Toronto, Ontario

THE QUALITY LEADER IN PUMPS, COMPRESSORS AND ROCK DRILLS

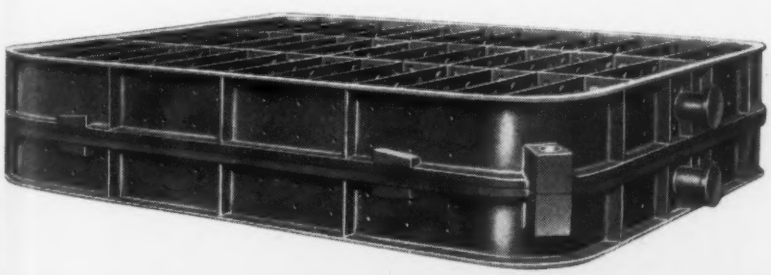


EVERYTHING in Steel Flasks



If you have a casting problem which requires a Flask of special shape or unusual construction —call your Shanafelt representative. He will check over the requirements with you and arrange for engineering detail and price quotations on Flasks made exactly the way you want them.

The four illustrations are typical of many special Flasks which were engineered and built here to meet special casting conditions.



Shanafelt Pins and Bushings are made solely for Foundry Flasks. The steel analysis, the tolerances and shapes, the degrees of hardening, are all based on the known requirements of Flask handling. You'll get a correct line-up of cope and drag if your Flasks are equipped with accurate, long wearing Shanafelt Bushings and Pins.

The SHANAFELT Manufacturing Co.

Serving the Foundry Industry for 57 Years

2600-2700 WINFIELD WAY N. E. • CANTON, OHIO

UNIVERSAL FLASK PINS

STAND PLENTY OF PUNISHMENT . . .

THUS SAVE REPLACEMENT TIME AND COST

Universal Flask Pins and Bushings are made to really stand up no matter how much punishment they're given in the foundry. They seldom break or bend—in spite of the beating they take on the shakeout. The bushings show a minimum of wear despite continuous use.

The reason: Universal Flask Pins and Bushings are heat-treated and precision ground from high quality steel with the same close tolerances found in machine tool work. Because they stand up, Universal Bushings and Pins save the cost and the down-time that replacement always requires. Because of their precise design and construction, Universal Bushings and Pins allow perfect cope and drag alignment. And because all standard sizes are carried in stock you get prompt delivery. Special sizes and types to order. Complete information is available by requesting the Universal Catalog covering Flask Pins and Bushings. Direct your inquiries and orders to the office nearest you —1060 Broad St., Newark, N. J., and 5035 Sixth Ave., Kenosha, Wisconsin—or write to our home office.

UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 4, MICHIGAN

PROVEN DEPENDABILITY YEAR IN—YEAR OUT

PLUS *LOW-COST OPERATION*

(Installation of 1,000,000-volt unit — Campbell, Wyant and Cannon, Muskegon, Mich.)

General Electric Industrial X-Ray is a production tool that often pays for itself on the first job!

Scores of companies rely on radiography for that extra measure of assurance that comes from knowing — not guesswork. The high-voltage industrial x-ray unit illustrated above is noted for its low-cost operation and absolute dependability. Developed to high efficiency to satisfy the hectic production demands of World War II, it ideally meets today's foundry needs — both in the laboratory and on the production line.

Here's the experience of a Michigan automobile manufacturer: "An outstanding example of the contribution of radiography to the improvement of production processes resulted when examination of one type of crankshaft showed lack of fusion at the chill and pointed the way to improved techniques resulting in a savings conservatively estimated by the company to be $250,000 on a year's production." Write for booklet: "Radiography as a Foundry Tool." General Electric X-Ray Corporation, Dept. YY2, Milwaukee 14, Wisconsin.

GENERAL ELECTRIC
X-RAY CORPORATION

CITIES SERVICE

USE THE CORE OIL TAILORED TO YOUR CORE ROOM REQUIREMENTS

DELCO 30 SERIES CORE OILS HELP YOU TURN OUT BETTER CORES— CHEAPER— FASTER

That's right Mr. Foundryman—"better, cheaper, faster." And here's HOW. Cities Service Company has developed a Delco 30 Series core oil for your every core room requirement... a core oil you can depend on for superior performance at lower than average cost.

Here's what leading foundrymen report—

- "The big difference is in saving time and fuel in the oven, by cutting down both time and temperature—with no sacrifice of results in the finished core."
- "Results indicated 30 Series Delco Core Oil best suited our general overall work."
- "Best Core Oil I ever used!"
- "We are using one-fifth less oil, and the baking time in the ovens has been reduced approximately two hours."

No matter what type or size cores you make, whether your production is large or small there is a Delco Series Core Oil tailored for the job. Call in a Cities Service representative and ask him to assist you in selecting and applying the correct grade of Delco Core Oil for your specific needs. This service is prompt, reliable, valuable and free. Cities Service Oil Company, Chicago, Cleveland, Kansas City, St. Paul and Toronto; Arkansas Fuel Oil Company, Shreveport.

Features of Cities Service 30 Series Core Oil that are building preference throughout the industry.

BETTER PERFORMANCE in core boxes, whether blown or hand rammed, whether sand is washed and dried or crude.

FASTER DRYING TIME without recourse to older types of drying oils.

WIDE RANGE OF WORKING TEMPERATURE—ready for use without pre-conditioning, whether in Texas or Montreal.

BAKES OUT AT LOWER TEMPERATURE, saves time, oven capacity and fuel.

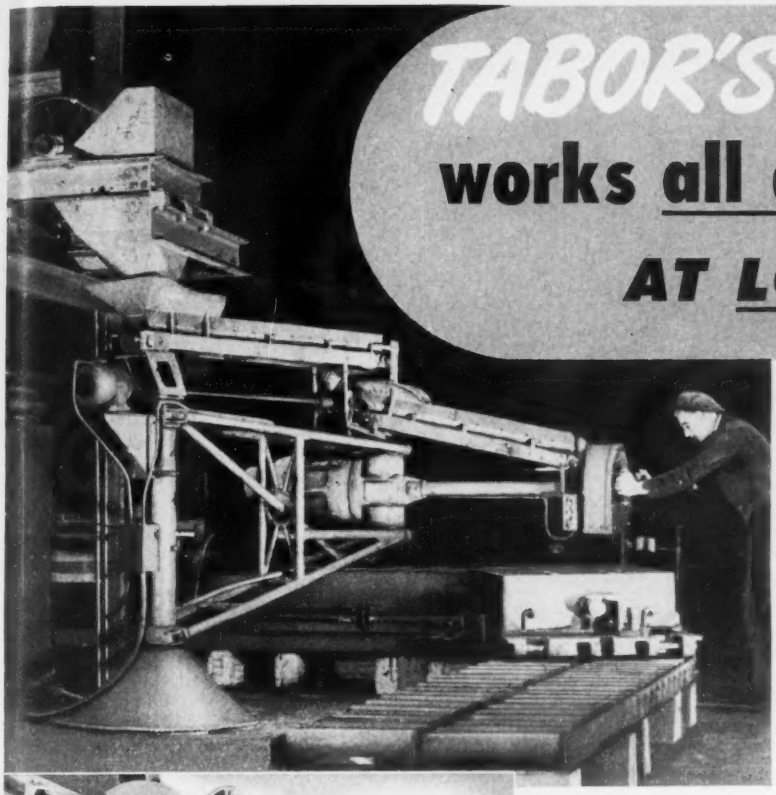
HAS A CLEAN, PLEASANT ODOR.

MADE IN FIVE QUALITY RANGES accommodating all local foundry and core room conditions.

DELCO CORE OILS • ROSINAL LIQUID CORE BINDER • DELCO CORE AND MOLD WASH

CITIES SERVICE

TABOR'S SANDRAMMER works all day—every day AT LOW COST



Assume the Sandrammer pictured is in *your* foundry. Why did you "buy" it and what's it "doing" for you?

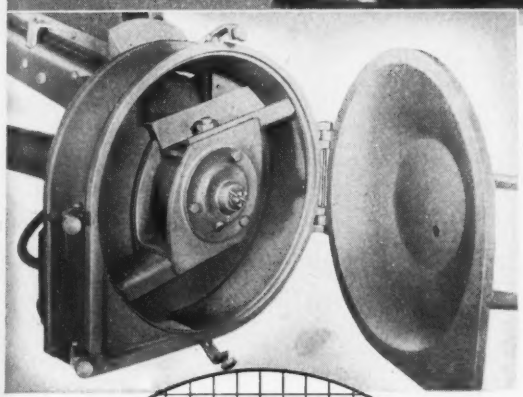
(1) Its *first cost was low*—justified its use where such equipment formerly seemed "out of the question".

(2) You respect it as a first-class production machine. You've got it on heavy foundry floor work. But you can switch it over to making large cores—or to long-run production of cores. You keep it busy around the shift—around the clock.

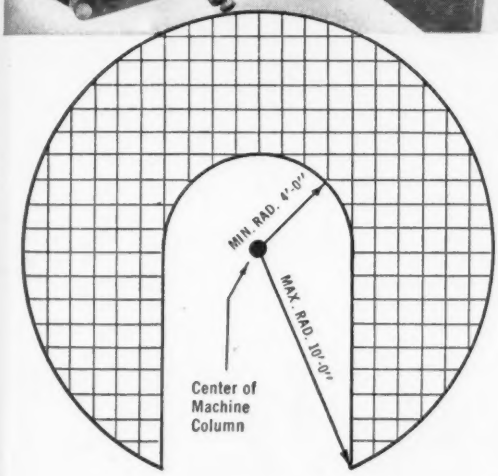
(3) It's flexible. You arranged it with a roller conveyor, but it's just as adept with a pit or turntable set-up.

(4) It's *paying off*—ramming more molds, better molds, a greater range of mold sizes and depths. Your operator likes its balance, "feel", push-button control. And, it's strong, dust-protected, built to last.

Shouldn't this Sandrammer *be* in your foundry?



Adjustable, multi-blade impellors give greater ramming speed and five-fold life. Simple blade adjustment compensates for wear and controls density of mold. Rams mold with equal density throughout whole area and depth.



The blocked portion of this diagram shows working floor area covered by ramming head of Sandrammer. Since each block represents one square foot, this sketch quickly tells you the combined maximum lengths and widths of molds which the Sandrammer can handle.

SANDRAMMER SPECIFICATIONS

Height from floor to top of feed chute	7'-0"
Height from floor to sand discharge point	3'-0"
Max. height of flask	2'-9"

(Sandrammer—being stationary—can be mounted on a raised concrete base, thus increasing maximum height of flask at no sacrifice to ramming efficiency.)

Sand throwing capacity ..... Up to 500 lbs. per minute

Write, wire or 'phone.
A Tabor engineer will be ready to team up with you.

The TABOR Manufacturing Co.

SINCE 1884 MANUFACTURERS OF FOUNDRY MOLDING MACHINES
6225 TACONY STREET • PHILADELPHIA 35, PENNA.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

Tabor Manufacturing Co. is licensed to manufacture and sell Sandrammers by Foundry Equipment, Ltd., Leighton Buzzard, Bedfordshire, England.

SCENE: Pouring molds in large foundry
EQUIPMENT: JEFFREY MOLD CONVEYORS
REASON: To speed up production, reduce costs
OTHER UNITS: Flask Fillers, Sand Conditioning and Handling Equipment
WHAT TO DO: Send for a JEFFREY Foundry Engineer

THE JEFFREY MANUFACTURING COMPANY
ESTABLISHED 1877
907 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

Baltimore 2 · Beckley, W. Va. · Birmingham 3 · Boston 16 · Buffalo 2 · Chicago 1 · Cincinnati 2 · Cleveland 15 · Denver 2 · Detroit 13 · Harlan, Ky. · Houston 2 · Jacksonville 2 · Milwaukee 2 · New York 7 · Philadelphia 3 · Pittsburgh 22 · St. Louis 1 · Salt Lake City 1 · Scranton 3

Jeffrey Mfg. Co. Ltd., Montreal, Canada
Jeffrey-Galion (Pty.) Ltd., Johannesburg, S.A.
The Ohio Malleable Iron Co., Columbus, Ohio
British Jeffrey-Diamond Ltd., Wakefield, England
The Galion Iron Works & Mfg. Co., Galion, Ohio
The Kilbourne & Jacobs Mfg. Co., Columbus, Ohio

FOUNDRY News Report

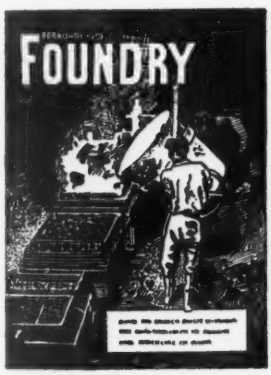
Jan. 25, 1951

PIG IRON NOT CRITICAL: Industry's expectations that stricter control over pig iron, including definition of permitted end uses, is in immediate prospect are not shared by Washington officials. The latter point out that part of the supply problem automatically will be taken care of by the fact numerous consumers will need fewer iron castings because their operations will be cut by shortages of other metals. Automobile companies, for instance, told NPA their first quarter production will be reduced 25 per cent for this reason.

MORE IRON EVENTUALLY: Considerable blast furnace capacity is included in the large expansion program now under way by the steel industry. Present annual pig iron producing capacity is 72,471,780 tons; it likely will be 5 to 10 per cent higher by the end of 1952. Most of the new capacity, of course, will be for steelmaking iron, but some definitely is marked for foundry use. One merchant stack is planned for the Pittsburgh district. Meanwhile, foreign pig iron is becoming an increasingly important supply source for domestic users. Imports the first ten months of 1950 totaled 476,400 gross tons, nearly one-fourth of which was received in October. Principal suppliers last year were Holland, Canada, Germany and Austria.

CMP SEEN ANSWER: Feeling in Washington is that revival of the old Controlled Materials Plan ultimately will be necessary to balance metal supply and demand. NPA orders already introduced to restrict uses of copper, aluminum, zinc, etc., are regarded somewhat as stop-gaps, but before introduction of CMP it appears that the DO ratings will be extended to cover essential civilian needs as well as defense orders.

STOCKPILING TO CONTINUE: An important reason for stringency in supplies of certain nonferrous metals is that expanding military needs are piled on top of both heavy civilian demand and stockpile requirements. Defense authorities consider it essential to continue the stockpiling program, reserving use of materials so accumulated for all-out war.



THE COVER: Pouring diesel engine cylinder heads at the recently modernized foundry of National Supply Co.'s Engine Division, Springfield, O.
See page 92

ALUMINUM OUTLOOK: No real easing in aluminum supply is seen until late 1952 or 1953. By that time new primary aluminum capacity and the plants now being reactivated are expected to make a reasonably easy supply situation. Meanwhile, coming application of restrictions on certain civilian uses will help to conserve metal for defense and other essential purposes. Savings by these limitations may range up to 10 per cent of current annual aluminum producing capacity.

FERROALLOYS: Manganese supplies are barely adequate to meet defense and civilian demands, and some conservation program for ferromanganese likely will be instituted. At the same time, ferrosilicon interests say there is no need for NPA controls on their product; sufficient supplies supposedly are in prospect through reconditioning and converting existing furnaces and other facilities, plus new construction now in progress.

OTHER RESTRICTIONS: Metals on which orders limiting their end use are looked for include molybdenum and zinc. The former has been affected by restrictions on tungsten use. Limitations on zinc are not expected to affect prime western metal employed in galvanizing, but would apply to high grade metal use in die casting.

COPPER ORDER: The order limiting uses of copper and copper-base alloys would appear to affect castings less than other forms and products. Production of brass and bronze castings this quarter is limited to 100 per cent of average quarterly production during the 1950 first half. Output of copper and brass mill products in January and February is limited to 85 per cent of the base period rate and in March to 80 per cent. However, early part of the base period was relatively slow for most brass founders.

MORE CUTS IN MARCH: Starting Mar. 1, use of copper in both cast and wrought form will not be permitted for a large number of purposes, including builders' hardware, certain other building materials and miscellaneous house-

hold, commercial and motor vehicle applications. Manufacturers are permitted to complete and sell affected items if they were in process of manufacture on or before Mar. 1 and are completed not later than Apr. 30. While 1950 copper refinery production was comparable to that of the war peak, and imports were heavy, large consumption and stockpile requirements have intensified the shortage of this metal as military needs expand.

JOINS ESA: Edward J. Metzger, formerly plant manager in charge of all aluminum and bronze operations for Wellman Bronze & Aluminum Co., Cleveland, has joined the Economic Stabilization Agency as metals consultant. He is located in Tempo E. Bldg., telephone Sterling 4200, extension 4395.

PLANT EXPANSION: Necessity certificates issued by the National Security Resources Board for rapid tax write-off to expand defense production facilities so far have included relatively few foundries in any but small amounts for moderate additions to facilities. Major items on recent lists were $1,353,000 for Albion Malleable Iron Co., Albion, Mich., and $2,152,000 for the jointly owned Capitol Foundry Co. and Arizona Iron Works, Phoenix, Ariz.

MACHINE TOOLS: Foundries serving the machine tool industry should be busy for many months. Plans for a sharp increase in tool production in the near future will cover equipment subsequently to be needed in proposed defense plants. NPA also is attempting to facilitate the freight car building program by authorizing builders to specify in advance the kind and amount of materials needed, and the period during which shipment is required. Scheduled delivery of 10,000 new freight cars monthly will require about 25,000 tons of castings.

NEW FEF SCHOOL: Illinois Institute of Technology, Chicago, with an initial grant of $2500 becomes the 13th engineering college to participate in the program of the Foundry Educational Foundation to interest students and provide them basic training for careers in the foundry industry.

PRICES OF FOUNDRY METALS AND COKE

(As of Jan. 24, 1951)

FOUNDRY COKE

(Per net ton, f.o.b. ovens)

BEEHIVE	
Connellsville	$17.00-18.00
New River	19.50
Wise County	15.95
OVEN	
Birmingham	$20.30
Chicago	21.00
Detroit	24.00
Erie, Pa.	23.50
Everett, Mass.	24.80
Indianapolis	22.75
Kearney, N. J.	22.75
Milwaukee	23.75
Painesville, O.	24.00
Philadelphia	22.70
Pittsburgh	23.00
Portsmouth, O.	21.50
St. Louis	24.25
Swedeland, Pa.	22.00
Terre Haute, Ind.	22.50

PIG IRON

(Per gross ton, f.o.b. furnace)

	No. 2 Foundry	Malleable
Bethlehem, Pa.	$54.50	$55.00
Birmingham	48.88	....
Buffalo	52.50	53.00
Chicago	52.50	52.50
Cleveland	52.50	52.50
Everett, Mass.	53.25	53.75
Fontana, Calif.	58.50	....
Geneva, Utah	52.50	....
Granite City, Ill.	54.40	54.90
Lone Star, Tex.	48.50	48.50
Pittsburgh	52.50	52.50
Steelton, Pa.	54.50	55.00
Swedeland, Pa.	56.50	57.00
Toledo, O.	52.50	52.50
Troy, N. Y.	54.50	55.00
Youngstown, O.	52.50	52.50

NONFERROUS INGOTS

BRASS AND BRONZE: 85-5-5-5—29.00c; 88-10-2—43.25c; 80-10-10—35.00c; No. 1 yellow—25.00c. **ALUMINUM:** 99 per cent plus, primary ingots 19.00c. Secondary No. 12 alloy 29.50-30.25c. **MAGNESIUM:** 99.8 per cent standard ingots 24.50c, f.o.b. Freeport, Tex.

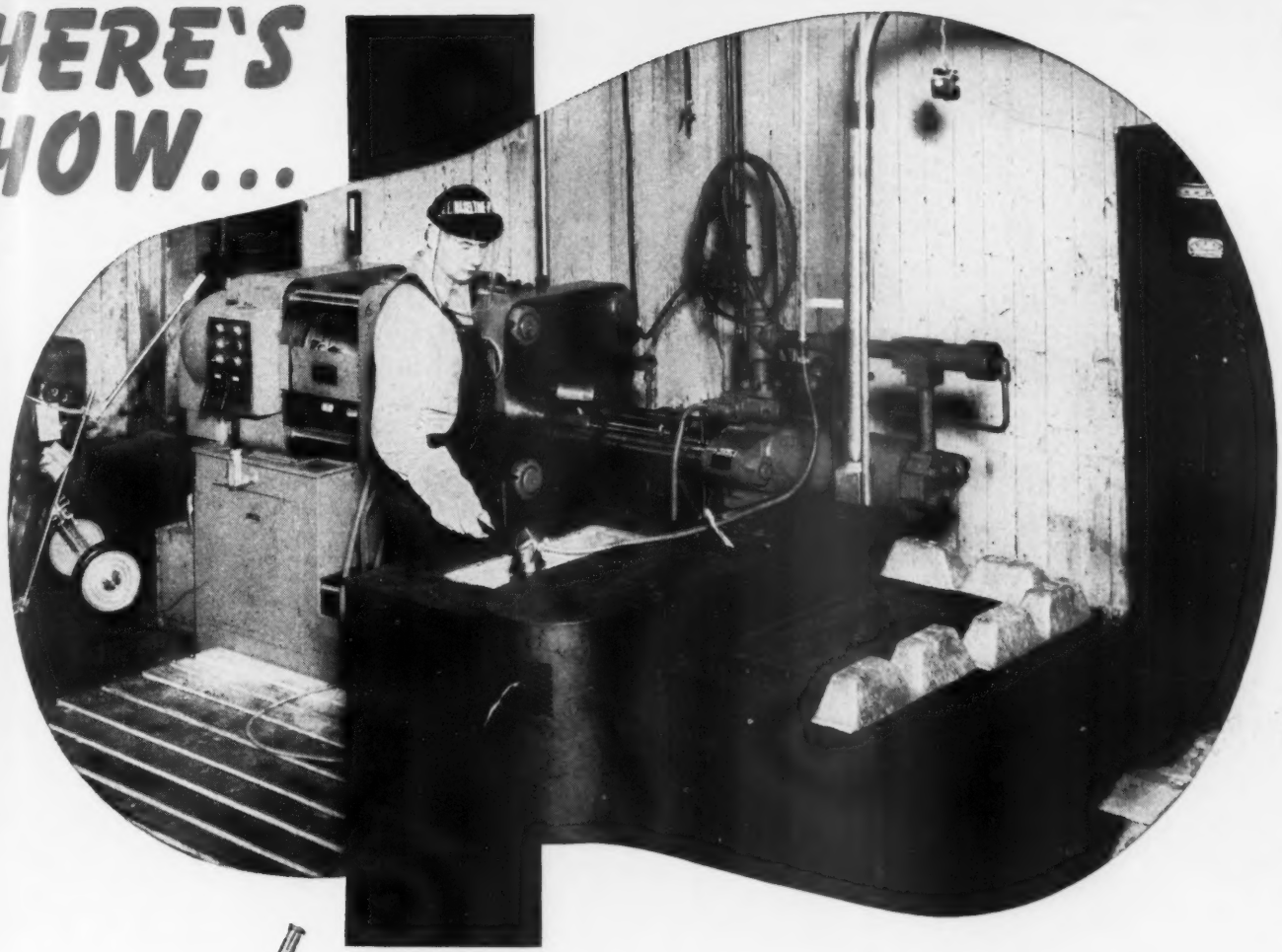
IRON AND STEEL SCRAP

(Consumer prices per gross ton, except as otherwise noted)

	No. 1 Heavy Melting Steel	No. 1 Cupola Cast	Stove Plate	Heavy Breakable Cast	Low Phos., Electric Furnace	Malleable	Short Steel Rails
Birmingham	$42.00-43.00	$55.00-56.00	$49.00-50.00	.....	.....	.....	$65.00-66.00
Boston*	35.67	46.00-47.00	42.00-43.00	43.50-44.50	44.50-45.00	.....	.....
Buffalo	51.00-52.00	54.00-55.00	.....	.....	48.25-49.00	60.00-61.00	60.00-61.00
Chicago	45.00	61.00-63.00	49.00-50.00	.....	52.00-54.00	73.00-75.00	66.00-68.00
Cincinnati	46.00	70.00	55.00	56.00	62.00	64.00	72.50
Cleveland	45.50-46.00	65.00-66.00	55.00-56.00	55.00-56.00	48.00-48.50	72.00-73.00	71.00-72.00
Detroit*	40.25	54.00-55.00	.....	46.00-48.00	42.75-46.00	.....	.....
Los Angeles	30.00	45.00-48.00	.....	.....	42.00-45.00	.....	.....
New York*	42.00-44.00	47.00-48.00	.....	44.00-45.00	44.50	.....	.....
Philadelphia	47.50	54.00-55.00	.....	54.00-55.00	51.00	70.00-72.00	66.00-67.00
Pittsburgh	46.50	58.00-60.00	.....	54.00-55.00	56.00-57.00	.....	68.00-70.00
San Francisco	30.00	43.00-45.00	.....	.....	45.00	.....	.....
St. Louis	46.00-47.00	58.00-60.00	45.00-47.00	56.00-57.00	.....	63.00-65.00	65.00-67.00

*Brokers' buying prices

HERE'S HOW...



Bag Boy® MANUFACTURERS INCREASED PRODUCTION RATE 5 TIMES

. . . with the LINDBERG-Fisher 2-Chamber Furnace

Consult your Lindberg-Fisher representative for recommendations on your production problems.

Jarman-Williamson, Portland, Oregon, manufacturers of BAG-BOY—the folding golf cart, utilize the Lindberg-Fisher 2-Chamber Melting Furnace in casting 14 parts for the BAG-BOY. Here's their story as they told it to us:

"Deluxe wheels on our BAG-BOY were becoming a bottleneck. When we used a sand cast wheel, one man on an 8-hour shift averaged 108 wheels—(MACHINING TIME ALONE)! We installed a Lindberg-Fisher 2-Chamber induction furnace as a running mate to our H.P.M. die casting machine. Management policy of buying the best for the job has already paid off—the nine-inch wheel is hitting the assembly line at the rate of 100 an hour. Using a 1¼ lb. shot at a temperature of 1180°F, rejects are less than 5% We're running 180 lbs. of metal through the furnace an hour (including trimmings, scraps, etc.) with no appreciable temperature variation from the necessary 1180°F! This keeps our unit operating at peak performance. The operator does not depend on test shots or 'feel'.

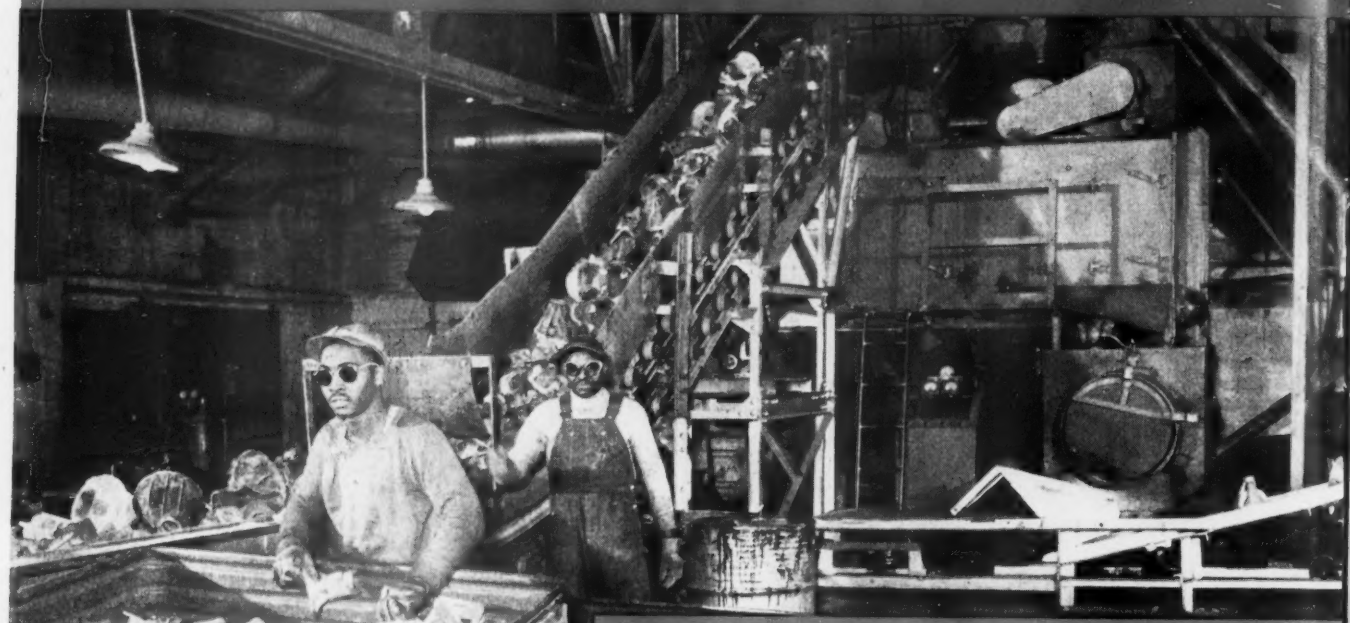
"As our operation has been running for only a short time it's too early to set up operation cost figures, but we do have some interesting facts: 1) Production rate is five times greater than the previous method; 2) During the weekend idling period, the furnace holds 500 lbs. of aluminum molten for 62 hours on 456 KW, which in Portland costs $4.62; 3) In one day, we charged 1440 lbs. of metal—and removed it at the rate of 3 lbs. per minute from the ladling side—no temperature variation could be noted; 4) We get a high percentage of good castings with comparatively inexperienced help. Our two operators made their first shots on this machine—within 30 minutes good castings were on their way to the production line. To a great extent this is attributable to the constant temperature maintained by our Lindberg-Fisher; 5) Our furnace is within arms reach of the shot well, allowing easier, smoother operation. This is possible only because of the extremely low heat loss from the furnace, which adds materially to the operators comfort and efficiency.

This sums up the fact that to date we are enormously pleased with our purchase. The Lindberg-Fisher induction furnace is proving all that was claimed for it by its representatives."

LINDBERG-Fisher MELTING FURNACES

LINDBERG ENGINEERING COMPANY • 2453 West Hubbard Street, Chicago 12, Illinois

WHEELABRATOR® CONTINUOUS TUMBLAST



1. Malleable castings being piled onto the loading conveyor of the 48" Continuous Wheelabrator Tumblast.

2. Sectional view of the Continuous Tumblast. Note the effective cross blast of the overhead Wheelabrator units.

3. A side view of the Continuous Tumblast with cleaned castings emerging from the machine onto the sorting conveyor.

THE AMERICAN WHEELABRATOR

American

WORLD'S LARGEST BUILDERS

cleans the work of 5 machines

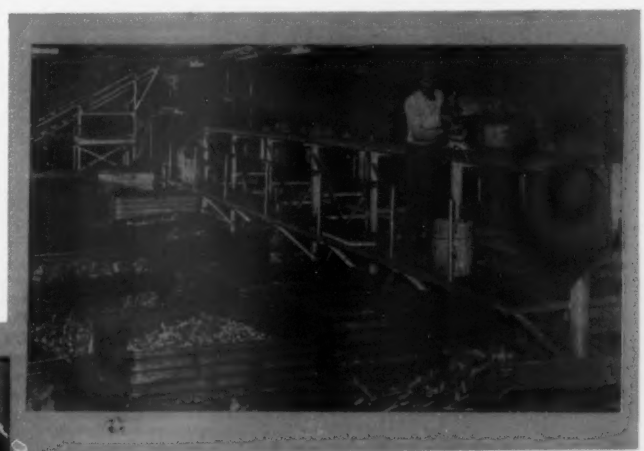
at AUTO SPECIALTIES MFG. CO.

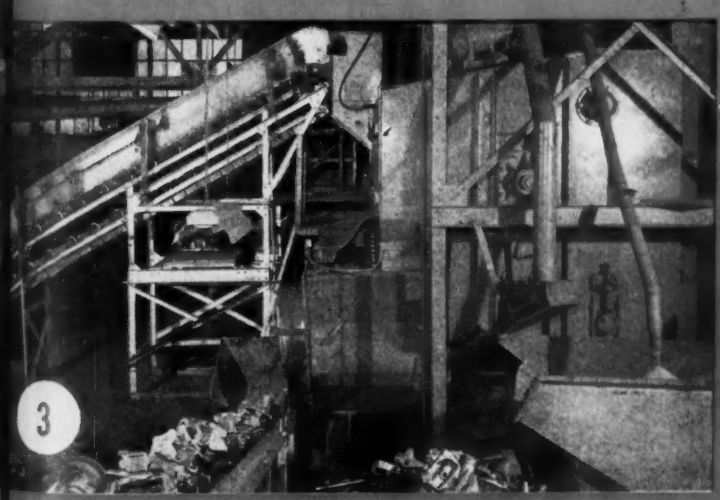
Sorting Labor Reduced 50%
Cleans 100 Tons of Malleable Daily
Savings Pay For Investment In 12 Months

Malleable casting cleaning at Auto Specialties Mfg. Company is now on a production basis as a Continuous Wheelabrator Tumblast cleans more than 100 tons daily in a continuous, smooth flow. From six to ten tons, often more, depending upon the type of casting are cleaned hourly. Five batch type machines, with operators, and a sorting and inspection crew were formerly required to handle this production in around-the-clock operation.

Savings realized with this high production cleaning machine are amazing. Labor costs are slashed—no operating labor required and sorting crew reduced over 50%. Plant efficiency is improved. Overall savings are estimated to return the complete investment in a year's time. As a result of this outstanding performance a similar machine has been installed in their Canadian plant. This is typical of the savings effected by the Wheelabrator in plants all over the country. It costs you nothing to find out how Wheelabrating can do a better, faster job for you—at a saving which ordinarily pays for machines in from six to eighteen months. Write for complete information today.

A general view of the casting sorting operation following Wheelabrating. From six to ten tons are handled hourly.





WRITE TODAY FOR BULLETIN NO. 514

It explains the functions and advantages of the Continuous Tumblast and shows how it is being used by a number of manufacturers.

WHEELABRATOR & EQUIPMENT CORP.

505 S. BYRKIT STREET
MISHAWAKA 2, INDIANA

MAKERS OF AIRLESS BLAST EQUIPMENT

USCO

Production Control

-WAYS BETTER

. . . Complete Metallurgical and Chemical Control

. . . Better Castings

. . . Positive Uniformity

. . . Fewer Rejects

FREE USCO Aluminum Alloy Selector. A handy aid to analysis, specifications and many other foundry problems.

For 47 years, pioneers in aluminum development.

USCO

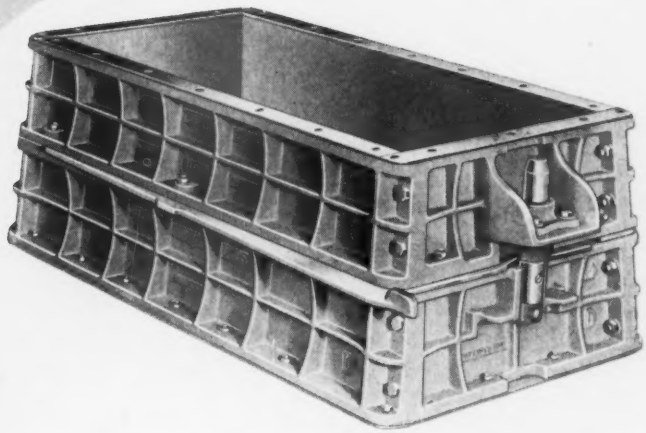
ALUMINUM

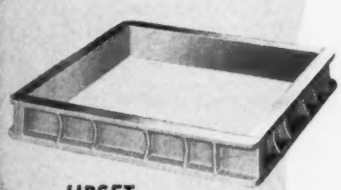
U. S. REDUCTION CO.

East Chicago, Indiana

FOR FAST, EXACTING PRODUCTION

Fremont heavy duty magnesium slip flasks . . .





UPSET

Built to withstand long, continuous usage in machine molding, yet one-third lighter with twice the tensile strength of aluminum. Solid, bolted and welded corner construction. Steel faced top and bottom flanges. Accurately machined inside surfaces and flanges.

The 1" dia. hardened and ground GROOVLOCK FOOLPROOF PIN assures perfect alignment indefinitely and is particularly adapted to cope or drag pattern jobs. Other types of standard pin fittings if desired.

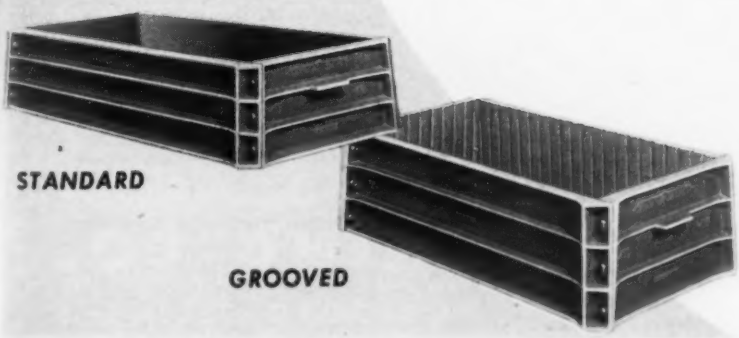
FREMONT CAST IRON OR CAST ALUMINUM JACKETS

Bolted corner construction, precision machined and drilled. Inside surfaces rough disc ground. Jackets ordinarily scrapped because of broken ends and sides can be salvaged at slight cost by removing a few bolts and inserting a new replacement side or end casting.

Two styles—the standard for ordinary foundry practice and the grooved for steel foundries. The ribbed construction permits ready gas escape.

Fremont flasks and jackets can be assembled on a 3°, 4° or 5° taper.

All orders given prompt attention.



STANDARD

GROOVED

The Fremont flask co.

FREMONT, OHIO

SAND IS ONLY PART OF THE PICTURE

Our Practical Foundry Service Men Are Ready to Help You!

Every foundry . . . at one time or another . . . faces the problem of developing new and intricate cores for specific jobs. Whenever such situations occur and cause you lost time and no end of trouble, call for one of our *Practical Foundry Service Men* to help you. These men have gained their know-how through years of actual foundry work . . . they are ready to take off their coats and go to work side by side with your own men. Call on us whenever we can be of service. No obligation, of course.

WAREHOUSE STOCKS AVAILABLE
In The Following Cities

- COLUMBIAN WAREHOUSE CO. — Reading, Pennsylvania
- FOUNDRY SERVICE CO. — Birmingham, Alabama
- E. R. FROST CO. — Minneapolis, Minnesota
- F. F. SHORTSLEEVE — Elmira, New York
- MALCOLM G. STEVENS — Arlington, Massachusetts
- PACIFIC GRAPHITE CO., INC. — Los Angeles 22, California
- TERMINAL WAREHOUSE — Worcester 8, Massachusetts
- M. W. WARREN COKE CO. — St. Louis, Missouri
- WESTERN FOUNDRY SAND CO. — Seattle, Washington
- WESTERN INDUSTRIAL SUPPLY CO. — Portland 14, Oregon

Smith L-O Core Oil

ROD DIP LIQUID PARTING

SMITH OIL & REFINING CO.
MANUFACTURERS OF L-O AND CERTIFIED CORE OILS
INDUSTRIAL OILS DIVISION . . . ROCKFORD, ILLINOIS

MOLD DRYING TIME REDUCED *to a minimum*

Automatic Features

ARE INCORPORATED IN

NEW Mold Drying Ovens

by

CARL-MAYER

From an article in May, 1950 issue of The Foundry

PICTURED here are views of two new modern drying ovens recently installed in the Oil Well Supply Co.'s foundry located in Oil City, Pa. This U. S. Steel subsidiary manufactures oil country machinery of all types and its foundries produce a wide weight range of both iron and steel castings, many of which are cast in dry sand molds. Through the medium of forced circulation and recirculation of hot gases or products of combustion, mold drying time is reduced to a minimum.

Each oven, having a capacity of 120,000 lb, is loaded by a mold-carrying car permanently connected to an under-the-floor automatic car pulling device, which by means of limit switches, cannot be operated until the oven door is wide open. Heat is produced in a dual fuel combustion chamber on top the oven, with an external mix type burner using either natural gas or fuel oil, the burners being provided with automatic fuel changeover devices as well as shutdown safety devices in case of fuel or power failures.

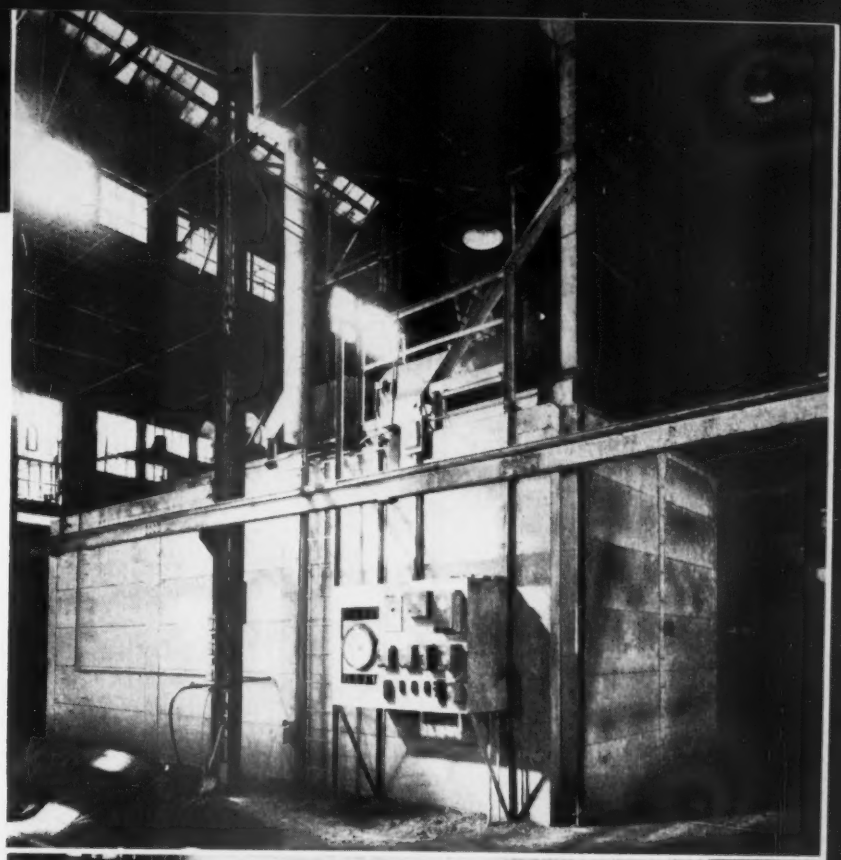
The combustion chamber, which consists of an insulation-covered stainless steel inner lining encased in a steel housing, is connected to a high-temperature fan of 13,000 cfm capacity, forcing the products of combustion through ducts discharging at floor level along both sides of the oven. The circulated hot gases are drawn out through ceiling ducts and about 70 per cent again go through the combustion chamber and are recirculated.

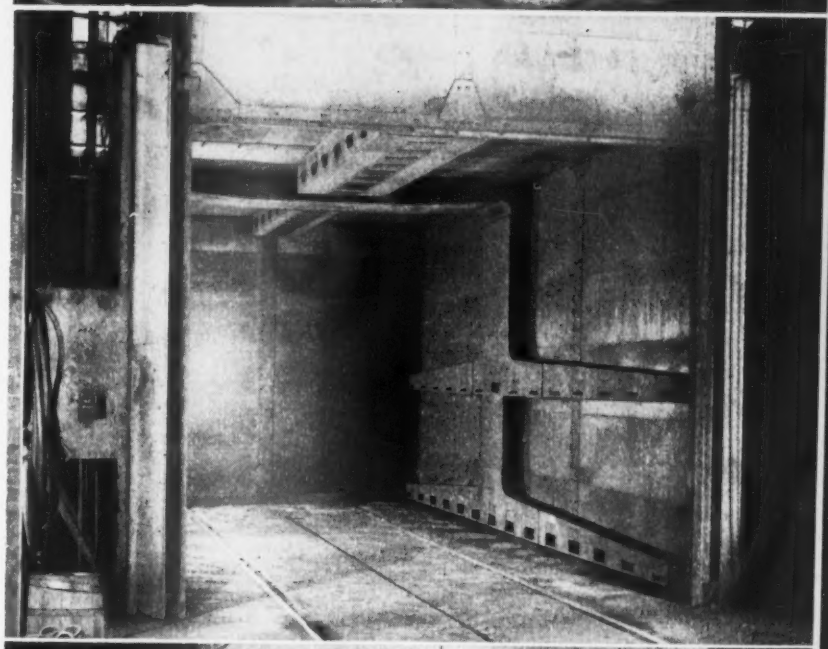
Prefabricated double wall sections, consisting of 5-in. thick glass wool insulation covered by 14 gage steel sheets, make up the oven walls and ceilings, and reduce firing time to 65 per cent of the mold drying time. The drying time cycle is completely automatic and in addition to the many safety protection devices, there is a delayed time firing device whereby the ovens are completely purged of any residual gases before the combustion chamber is ignited. The units were designed, fabricated and installed by

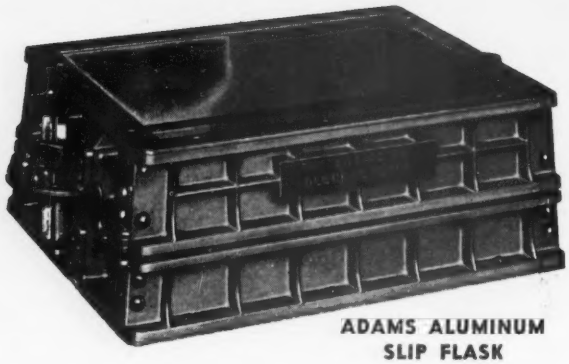
The Carl-Mayer Corp.

3030 Euclid Ave., Cleveland, Ohio

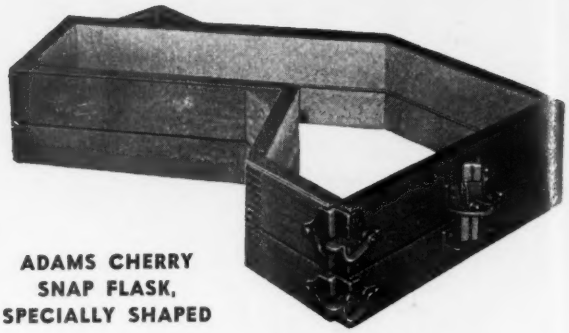
Over thirty years' experience in building all types of Core and Mold Ovens.







ADAMS ALUMINUM
SLIP FLASK



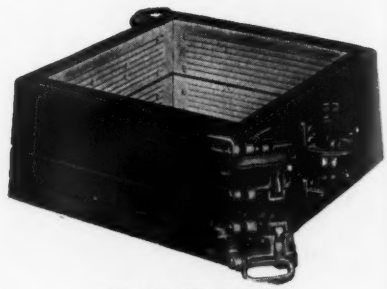
ADAMS CHERRY
SNAP FLASK,
SPECIALLY SHAPED

For "All-Out" Production use

ADAMS-BUILT

FLASK EQUIPMENT

Tell us <u>now</u> what you'll need

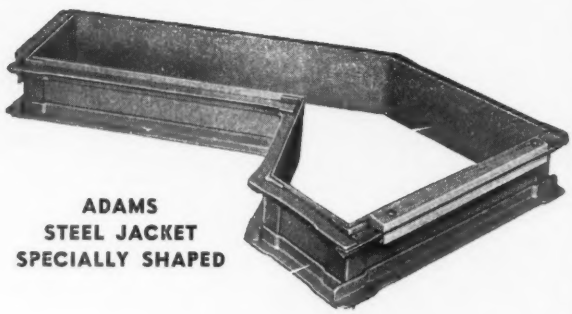


ADAMS CHERRY
EASY-OFF FLASK

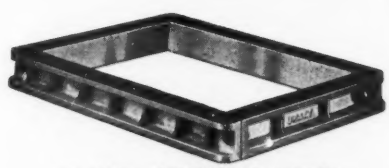
Lest the rising tide of "all-out" production swamp you with unfilled orders . . . we urgently request that you review the needs of your foundry for molding machines, flasks and allied equipment.

If you will then place your order at once, we shall make every effort to deliver your equipment on the date you must have it.

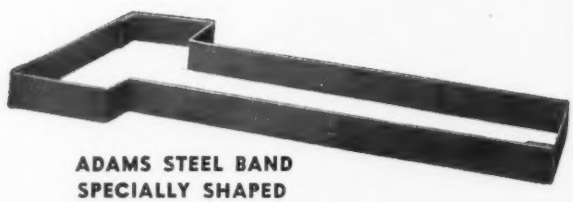
As you know, the battle of the production line is not won with "rejects". *Adams-Built* molding machines and flask equipment will help you to maintain peak production of high-quality castings, reduce rejects and lower production costs. May we hear from you now?



ADAMS
STEEL JACKET
SPECIALLY SHAPED



ADAMS ALUMINUM UPSET



ADAMS STEEL BAND
SPECIALLY SHAPED

THE ADAMS COMPANY
800 Foster St. Dubuque, Iowa

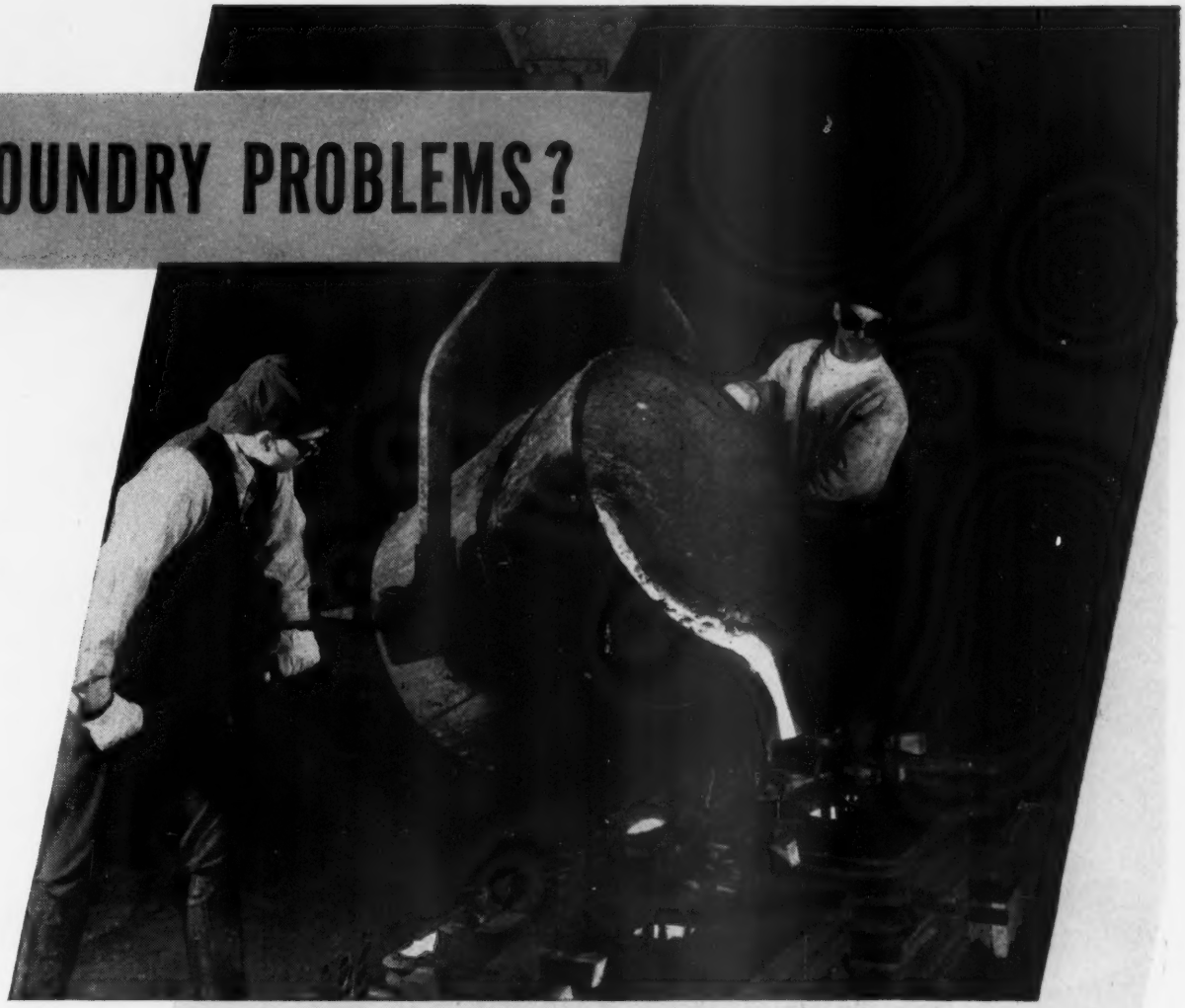
The ADAMS Company

ESTABLISHED 1883

MOLDING MACHINES and FLASK EQUIPMENT

DUBUQUE, IOWA, U.S.A.

FOUNDRY PROBLEMS?



Here's a man who can help you!

He's the Republic Pig Iron Metallurgist, a practical foundryman with years of actual foundry experience. He's an expert at solving foundry problems, because he knows irons, how they behave, and how to make them behave.

Often, a single phone call is all that's needed for him to spot the cause and furnish the solution to a troublesome problem. Or perhaps it will be necessary for him to pay your foundry a visit. In either case, you can be sure that he will respect your confidence, without reservation.

Republic—producer of America's leading pig irons—offers you the services of the Pig Iron Metallurgist without cost or obligation in any form. Write, wire or phone, for prompt help with any foundry problem!

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

Republic PIG IRON

"CHATEAUGAY" Low-Phosphorus, Copper-Free

"REPUBLIC" (Northern) Foundry, Basic and Malleable

"PIONEER" (Southern) Foundry and Basic

REPUBLIC STEEL

TWO SCREENS

GIVE EYES DUST-FREE PROTECTION

WITH THE

AO 306 DUST GOGGLE

Here's a goggle that does a top job of keeping workers' eyes free of fine dust particles and powders that irritate and contaminate. How? By a 150 mesh wire screen, set behind a 16 mesh screen. What's more, the "306" provides secure safety against sparks and flying particles . . . exceptional wide-angle vision . . . good ventilation and comfort. Your nearest AO Safety Products Representative can supply you.

QUICK FACTS

VENTILATION—Wire screen ventilators around eyecups provide ample ventilation—help keep lenses from fogging.

MASK—Flexible, plastic and bound at edges with soft sponge rubber, covered with pliable corduroy. Combines maximum comfort with tight fit.

LENSES—50 mm. Super Armorplate or 6 Curve Super Armorplate clear or Calobar in medium, dark or extra dark shades.

SIZES—Specify No. 306 for large or medium features, No. 308 for small features.

American Optical COMPANY

SAFETY PRODUCTS DIVISION

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES

FREEMAN *Dowmetal* PATTERN PLATES

All Plates Shipped Same Day Order is Received

TRY THEM FOR
COPE AND DRAG MOUNTINGS

FREEMAN DOWMETAL PLATES COST LESS

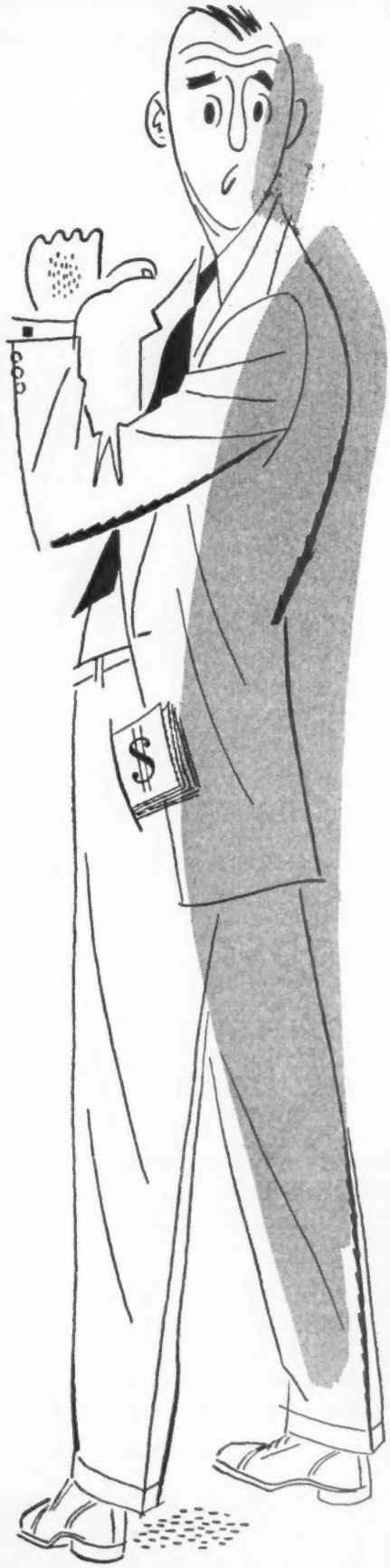
For years many foundries have used FREEMAN PATTERN PLATES as they are LIGHTER, STRONGER and IMMEDIATELY AVAILABLE in ANY SIZE AND QUANTITY. Surfaces are held to CLOSE PARALLEL TOLERANCES and plates are of UNIFORM THICKNESS.

With their clean VELVET FINISH, plates are received in proper condition for mounting patterns. Drilling, tapping and NECESSARY MACHINING to mount patterns is DONE MORE EASILY on free-cutting DOWMETAL PATTERN PLATES.

For regular pattern or cope and drag work, we can furnish ANY PRACTICAL SIZE 5/16"—3/8"—1/2"—5/8"—3/4"—1" THICKNESS. When ordered by flask size, we allow 1" for flask and 2-1/2" on each end for pins and ears. If square or rectangular plates are desired, specify overall size and thickness. For special shapes send a template or sketch. LITERATURE AND PRICE LIST AVAILABLE.

THE FREEMAN SUPPLY CO.

Pattern Shop and Foundry Supplies and Equipment
Mahogany and Pine Pattern Lumber
1152 E. BROADWAY TOLEDO 5, OHIO



WHO, ME, A PRESSURE SPENDTHRIFT?

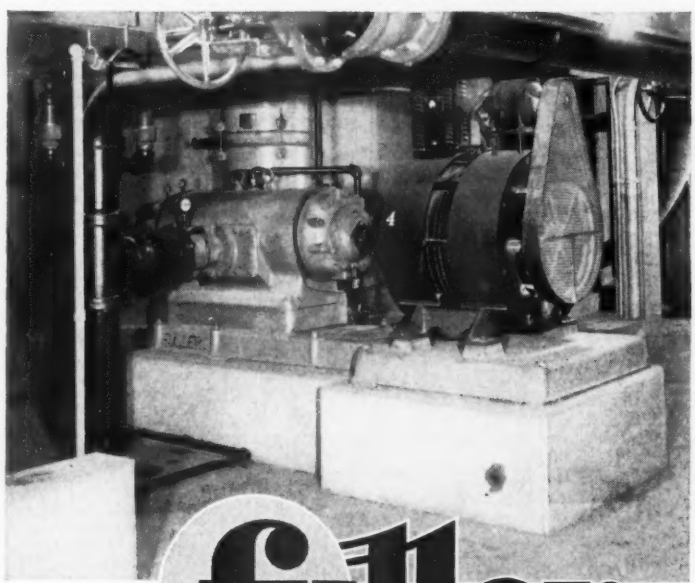
Let FULLER ROTARY COMPRESSORS supply just the pressure you need . . . WHERE you need it.

Sure, you need large, high pressure units to supply pressures equal to the demands of certain operations. But it costs plenty to compress air for these uses . . . and then have to reduce pressure from 10 to 50 lb. for some other task. That's why more and more plants throughout the country have adopted the economical plan of "spotting" Fuller Rotary Compressors wherever air is needed . . . at pressures up to 125 psig . . . supplying *only* the pressure required for most efficient work.

Fuller Rotary Compressors have few moving parts . . . the rotor, bearings and blades. They're fully dependable . . . need only infrequent inspection. There are no valves to leak or seats to grind. They're readily accessible. Blades automatically compensate for wear. *Full capacity is maintained for the life of the machine.* They're engineered for a full life-time of new machine efficiency.

If you're interested in dependable, more economical operation, get in touch with a Fuller engineer. He'll show you how you can be sure of getting just the pressure you want, where you want it . . . how you can cut installation and maintenance costs while you boost operating efficiency. There's no obligation, of course.

FULLER COMPANY, Catasauqua, Pa. • 120 S. LaSalle St., Chicago 3 • 420 Chancery Bldg., San Francisco 4



DRY MATERIAL CONVEYING SYSTEMS AND COOLERS
COMPRESSORS AND VACUUM PUMPS
FEEDERS, AND ASSOCIATED EQUIPMENT

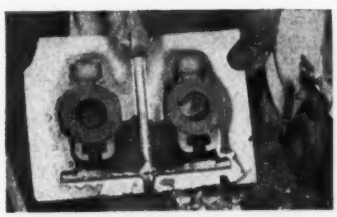
fuller

C-197

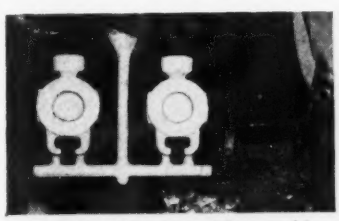
Resin bonded shell mold showing back (left) and face (right).

How to boost your production:

Use Monsanto Resinox resins with new shell molding process



Removal of casting from mold.



Casting after removal from mold.

Not only does the Shell Molding ("C") Process help you speed up production, but it enables you to get castings with a superior finish . . . and castings with dimensional accuracy comparable to that achieved by precision casting techniques. And there are other advantages you will want to look into:

1. Better metal yields (more castings per pound of metal poured)
2. Castings requiring little or no cleanup
3. Less sand handling
4. Excellent castings of intricate shapes and thin sections

Monsanto manufactures a wide range of Resinox phenolic resins research-built for the Shell Molding Process, and others already used by many foundries to improve cores, and reduce baking cycles up to 50%. *For more information about the new Shell Mold Process, and for data on Resinox for molds and core binding, please send the coupon below.* Resinox: Reg. U. S. Pat. Off

MONSANTO
CHEMICALS AND PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

MONSANTO CHEMICAL COMPANY, Plastics Division,
Room 5701, Springfield 2, Mass.

☐ Please send me your booklet, "The 'C' Process for Making Molds and Cores for Foundry Use."

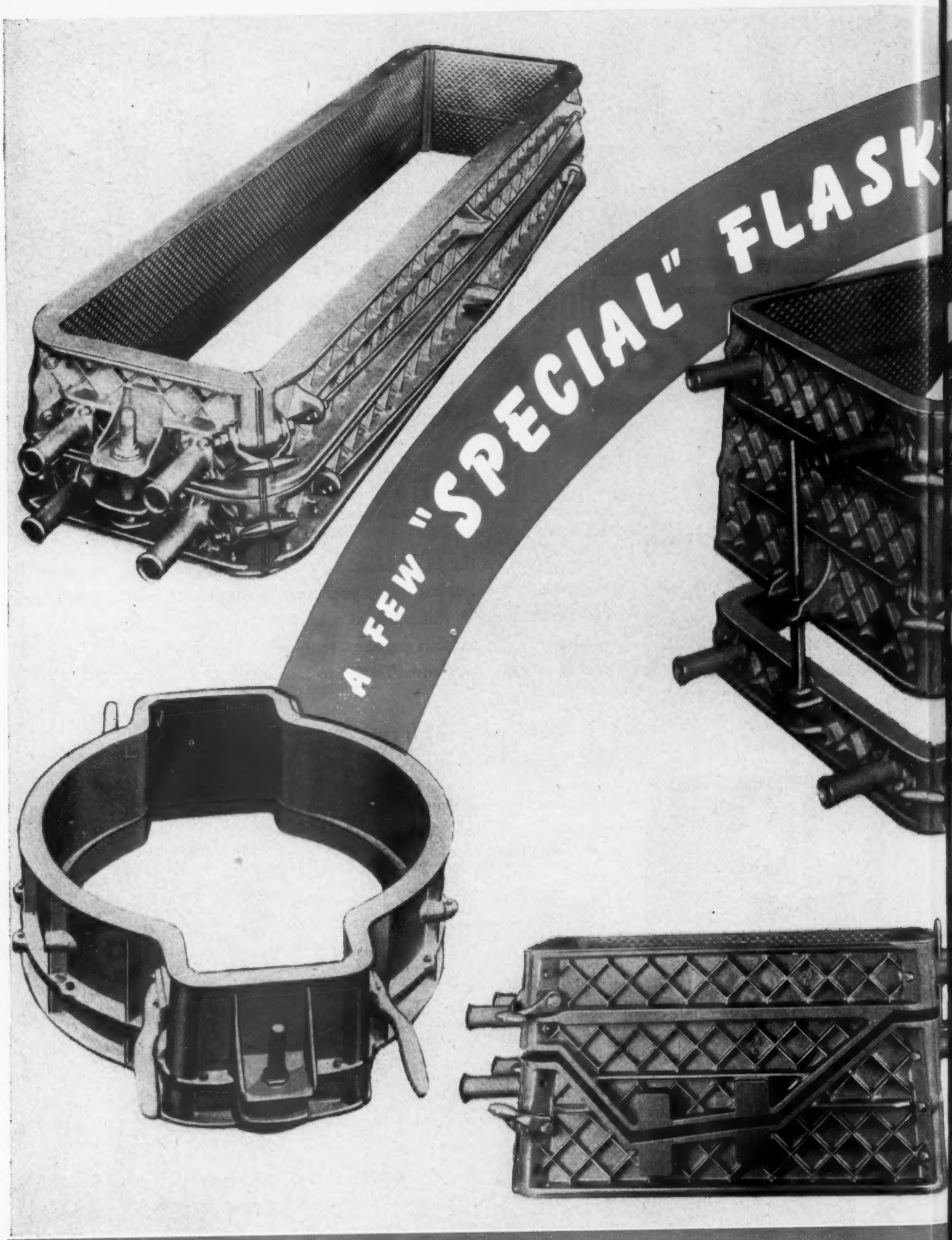
☐ Please send me information on Resinox for _____

Name & Title _____

Company _____

Address _____

City, Zone, State _____



THE HINES

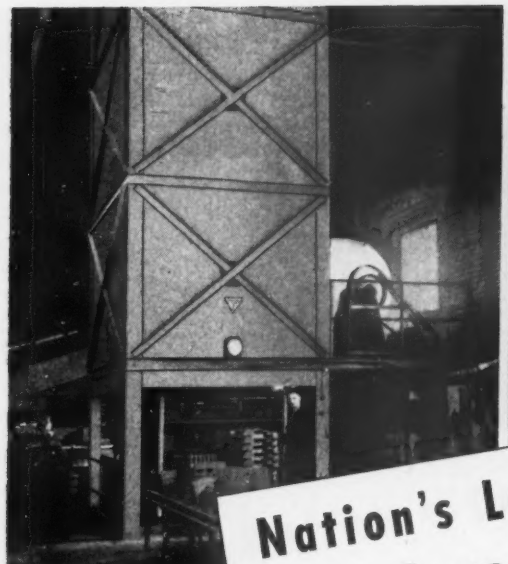
3431 WEST 140th ST.

Each of the flasks shown on these pages was designed by HINES to do a *special* job more efficiently. In many cases, HINES has succeeded in designing flasks for making castings originally thought to be impractical, or even impossible.

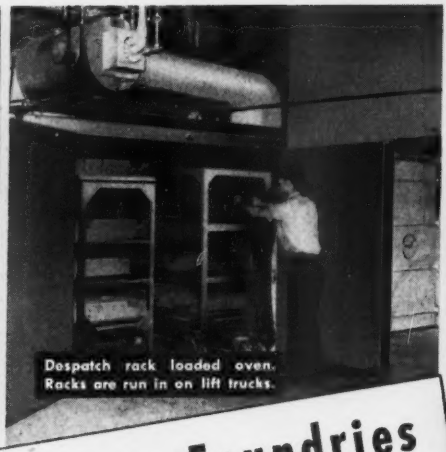
A HINES "special" may be the answer to that difficult molding problem now confronting you. We'd be glad to help —phone, wire or write TODAY.

FLASK CO.

CLEVELAND 11, OHIO



Despatch vertical type, continuous conveyor oven for limited floor space.



Despatch rack loaded oven. Racks are run in on lift trucks.

Core baking horizontal conveyor type oven in the Oliver Foundry.

Nation's Leading Foundries Bake Cores—Dry Molds Better, Faster and at Greater Savings with DESPATCH FOUNDRY OVENS

Many foundries using DESPATCH Ovens report improved core and mold quality with a minimum of rejects, reduced fuel cost up to 57% by actual test and increased output up to 70% with the same floor space. These advantages and many others are achieved with the DESPATCH system of convection heating and air circulation. Core baking and mold drying are more uniform because of the equal distribution of heated air to each unit of the load . . . it is done faster because heat transfer is speedy and moisture and fumes are removed quickly.

DESPATCH heating systems are designed to supply adequate heat for highest possible core and mold oven efficiency, whether gas, oil or electricity is used. DESPATCH Foundry Ovens are engineered and built to fit every core baking and mold drying operation. Several types are shown, and there are many combinations to fit the production and space requirements of all foundries.

DESPATCH engineers will analyze your core baking and mold drying problems and make their recommendations to save you production time at the lowest practical cost of installation. There is no obligation for this engineering service.

WRITE TODAY for Bulletin 31J or request a representative to call.

MINNEAPOLIS OFFICE:
619 S. E. 8th Street

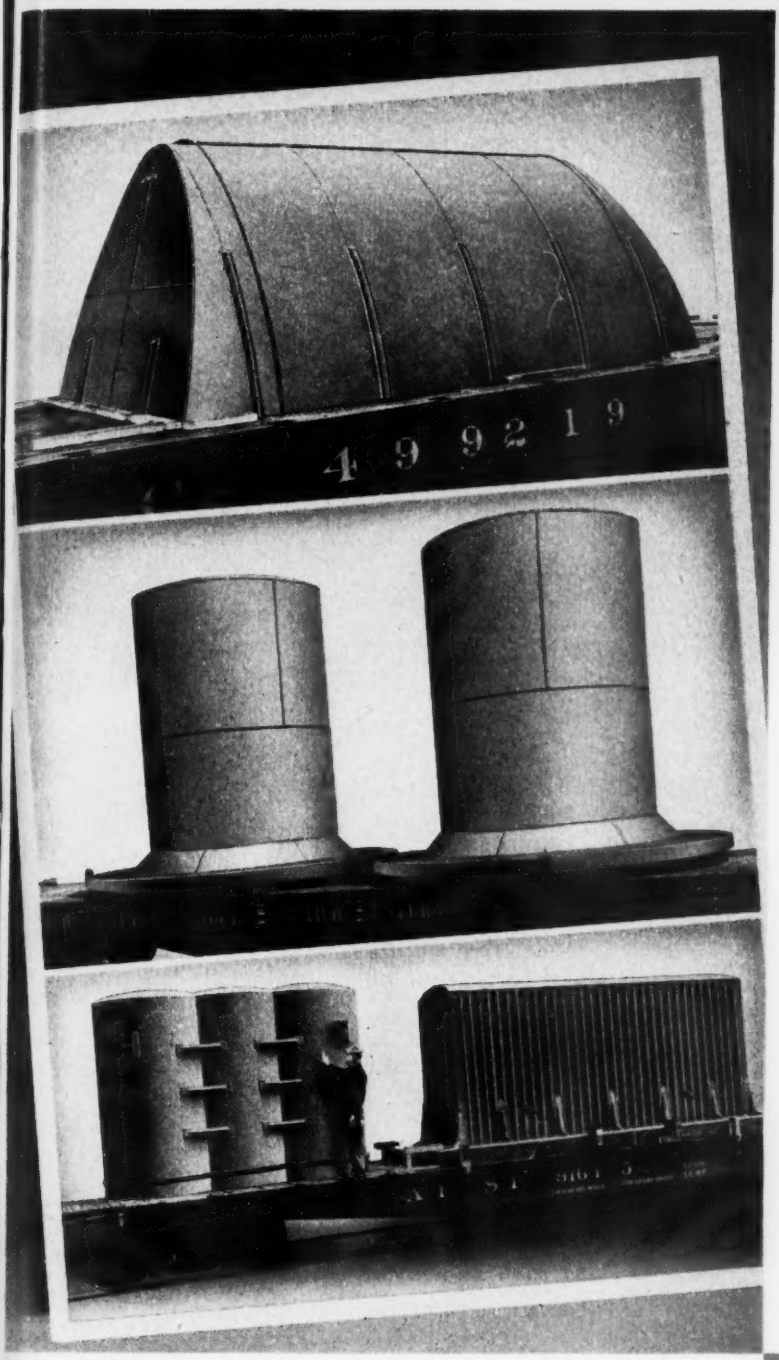
CHICAGO OFFICE:
7070 N. Clark Street

DESPATCH OVEN COMPANY

Despatch mold drying and core baking car type oven.

Despatch rolling drawer type oven. Ideal for large or small cores.

Continuous conveyor leaving Despatch overhead core baking oven in J. I. Case Foundry.



WOULD BIGGER COVERS CUT YOUR ANNEALING COSTS?

The operating economies of large annealing covers is obvious. Handling time is shortened when one cover replaces as many as eight. And larger covers permit larger volumes to be treated in each anneal. But installation records of large PSC covers show that other less obvious savings are effected. Made of light-gauge welded sheet alloy, they attain heat in less time; and they handle easier and faster. Being less bulky, PSC covers increase furnace capacities.

PSC "Light-Weight" Construction Makes Much Larger Covers Possible

We have made annealing covers as long as 21 feet. Because of the light-weight nature of PSC construction there is really no limit to the size of cover we can furnish. We fabricate from any alloy to meet your firing requirements. We invite you to take advantage of our 20 years experience in fabricating covers for the majority of the nation's steel mills and many leading foundries.

Weigh Up to 2/3 Less

All units in The Pressed Steel Co. complete line of heat-treating equipment, listed at right, are made of light-gauge welded sheet alloy. On the average, they weigh 2/3 less than cast equipment, resulting in outstanding savings. Yet their service life is 2 to 7 times that of cast equipment.

Light-Weight
Heat-Treating Equipment for Every Purpose

- Carburizing & Annealing Boxes
- Baskets · Trays · Fixtures
- Muffles · Retorts · Racks
- Annealing Covers and Tubes
- Pickling Equipment
- Tumbling Barrels · Tanks
- Cyanide and Lead Pots
- Thermocouple Protection Tubes
- Radiant Furnace Tubes & Parts
- Heat, Corrosion Resistant Tubes

THE PRESSED STEEL COMPANY
of WILKES-BARRE, PENNSYLVANIA

Industrial Equipment of Heat and Corrosion Resistant WEIGHT-SAVING *Sheet Alloys*

☆ ☆ ☆ OFFICES IN PRINCIPAL CITIES ☆ ☆ ☆

HAVE YOU FOUND THE ANSWER?

POOR QUALITY COKE

AS COKE GOES from bad to worse, it takes more for melting. Spout metal temperatures are down, and cupolas deliver less than rated capacity. Refractories burn out faster, and replacements are more expensive.

Costs are up . . . quality is down . . . rejects keep eating away at profits. And all the while customers demand higher and higher quality castings. Have YOU found the answer?

WE OFFER NO PANACEA

OW POURING TEMPERATURES

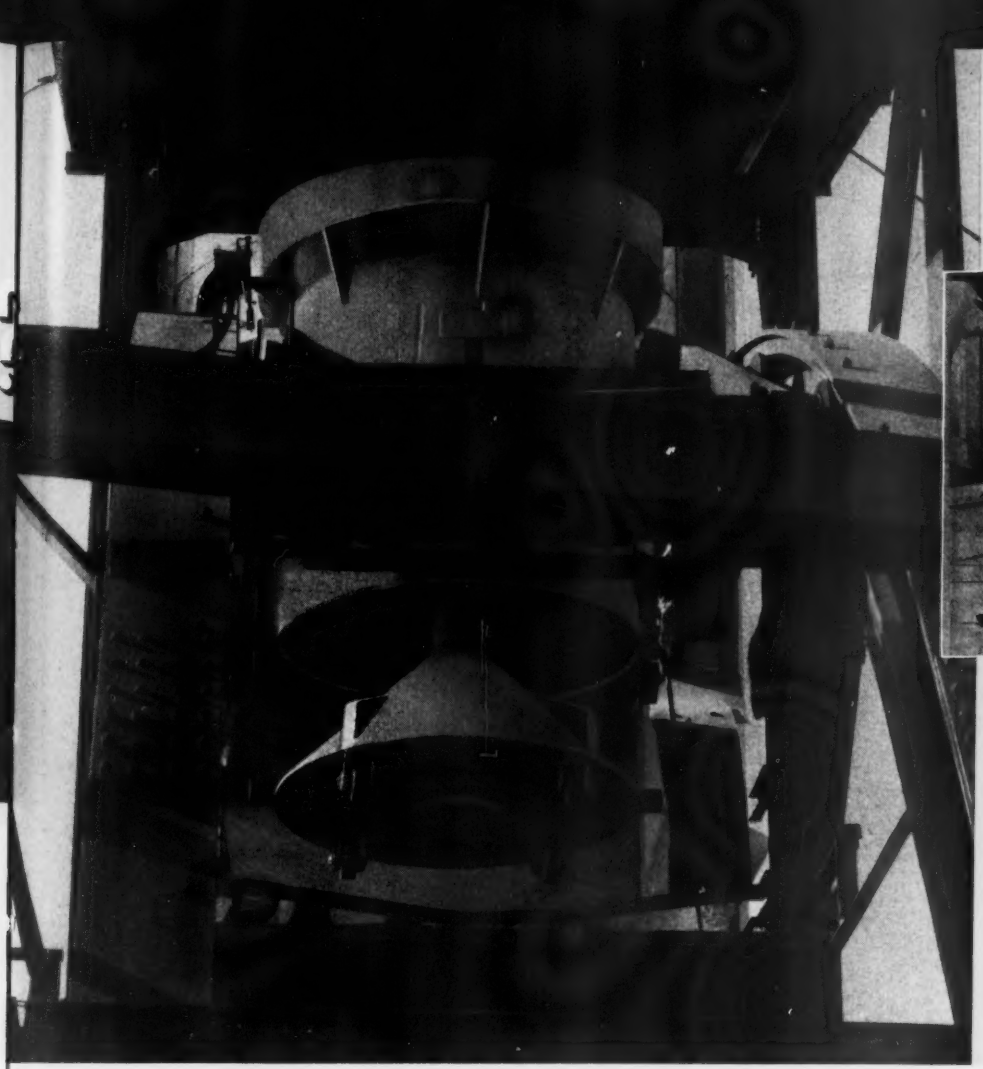
Whiting has been in the foundry business too long to suggest a cure-all . . . but foundrymen who have changed to Whiting Cone-Bottom Charging Buckets are amazed at the improvement in their melting practice.

One operator recently told us, "Since installing your cone-bottom bucket, we are getting the hottest iron we've had since 1937."

If you are having trouble, don't wait! Call for a Whiting sales engineer, today.

REFRACTORY BURNOUTS

TOO MANY REJECTS



← Whiting Cone-Bottom Bucket emerging from the cupola charging opening, ready to descend for reloading.

↑ Two views show operation of the automatic bucket-closing mechanism. At left, the bucket is open—cone about to come down against the bearing plates which raise it against the latch. In right-hand illustration, the bucket has closed and latched.

Whiting Cone-Bottom Buckets

FOR A MECHANICAL CHARGING JOB THAT CAN NOT BE EQUALLED EVEN BY THE BEST HAND-CHARGING PRACTICE

WHITING Cone-Bottom Buckets distribute the charge evenly around the outer edge and leave it more open in the center. Hence the blast distribution and gas flow are more uniform—bringing higher metal temperatures with less coke and less oxidation, and faster melting.

You can secure these benefits of cone-bottom charging from your present equipment by replacing drop-bottom buckets with Whiting Cone-Bottom Buckets. The new Buckets require no "wishbone" within the cupola; they are discharged by a release lever which opens automatically when the bucket arrives in discharge position in the cupola, and closes automatically as the bucket returns for loading. Full information on request.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

WHITING CORPORATION

15607 Lathrop Ave. Harvey, Illinois

Offices in Chicago, Cincinnati, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, and St. Louis. Representatives in other principal cities. Canadian Subsidiary: Whiting Corporation (Canada) Limited, Toronto, Ontario. Export Department: 30 Church St., New York 7, N. Y.

"We get 3 times the production with half the manpower"

A partial list of companies who have purchased THERMEX Electronic Core-Baking Equipment

- American Hardware Corp.
- Brugger Manufacturing Co.
- Crane Co.
- Grand Haven Brass Foundry
- Grinnell Company, Inc.
- Moline Malleable Iron Co.
- National Malleable & Steel Castings Co.
- Phoenix Brass Fittings Corp.
- F. Ronci Co.
- United Foundries, Inc.
- United States Pipe & Foundry Co.

THERMEX—T. M. Reg. U. S. Pat. Off.

BEFORE this progressive foundry* installed THERMEX Core-baking Equipment, oven baking of 240 typical cores took two hours. Now, with electronic baking, the same job can be done in 40 minutes! And one man operates the THERMEX Core-baking Equipment, where two men were required with an oven.

Here are other advantages realized...

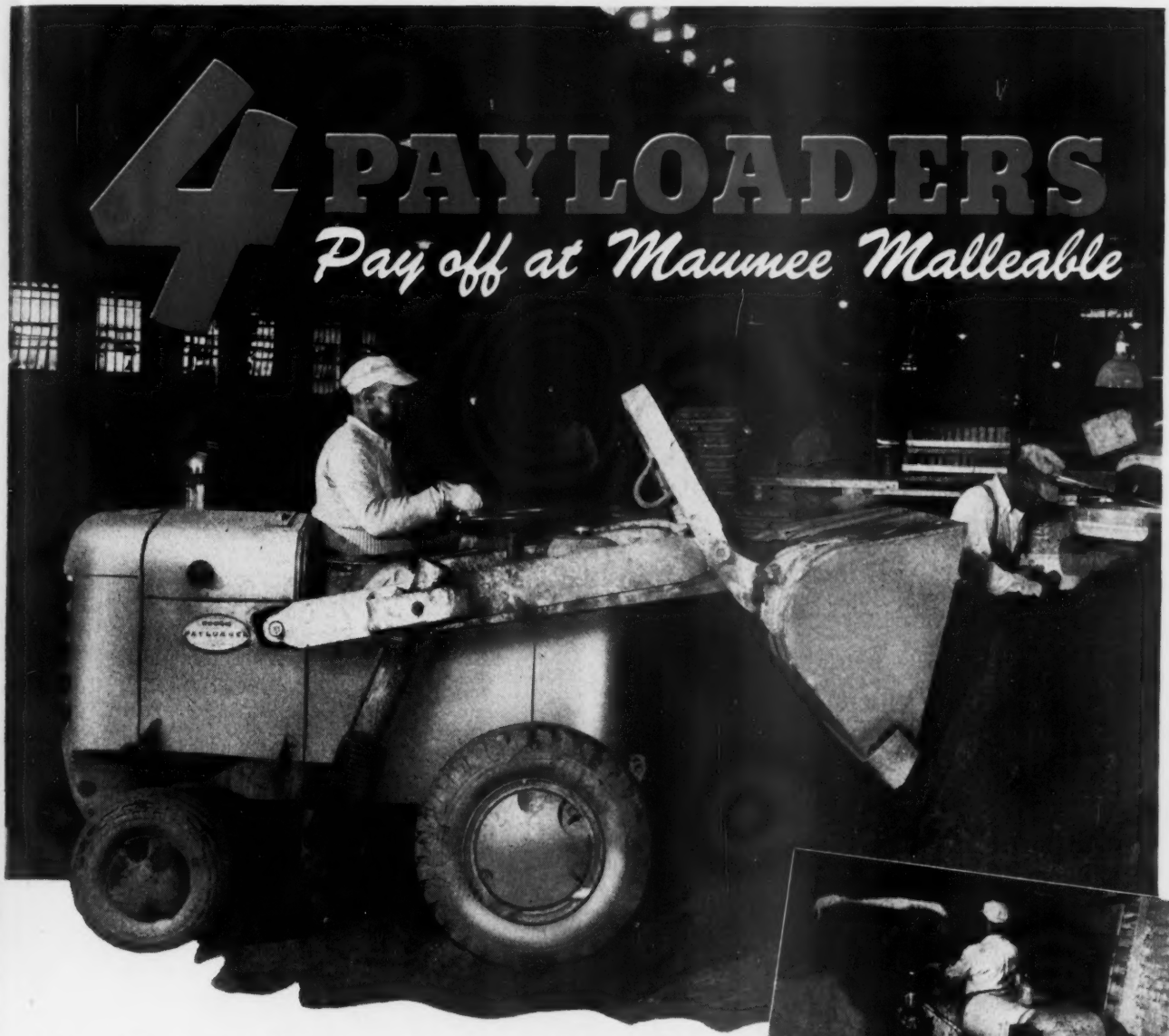
- 99% of cores now pass inspection, where reject rate formerly was 10 to 40%.
- "Dri-box", a plastic drier developed by Girdler engineers has proved perfect for the purpose.
- Requirements for core plates have been reduced by 75%—since baking time has been cut.
- Energy used varies with the requirement of the load—eliminates waste energy—unused power.
- A few standard mixes now take care of all cores.
- Baking tunnel is ready at the flip of a switch—no time is lost firing the oven.

Girdler has manufactured high frequency di-electric heating equipment in capacities from ½ ton to 15 tons per hour. You'll want complete data on THERMEX Electronic Core-baking Equipment. Write The Girdler Corporation, Thermex Division, Louisville 1, Kentucky.

*Name on request.

GIRDLER CORPORATION
Thermex Division

4 PAYLOADERS
Pay off at Maumee Malleable



Slash Handling Costs, Speed Production, Improve Quality

Four Model HA "PAYLOADERS" acquired by Maumee Malleable Casting Co., Toledo, during the past four years have provided these four important benefits: reduced costs, increased production, improved quality and stimulated employee morale.

Maumee's results with "PAYLOADERS" are echoed from scores of other foundries where "PAYLOADERS" have gone to work . . . digging, loading, carrying and dumping sand and many other materials such as slag, sprues, coke, scrap, flasks and annealing boxes.

One-man operated, the "PAYLOADER" does more work than a crew of shovel men . . . saves time, money and man-hours. It will pay you to find out how "PAYLOADERS" can pay off in your foundry as they have for Maumee and many others. Get the full story from your "PAYLOADER" Distributor or write The Frank G. Hough Co., 703 Sunnyside Avenue, Libertyville, Illinois.

Reduces sand handling time and costs, from box car to storage, mullers, sand cutters, molding stations.

Better, more uniform sand results from mixing 1,000 lb. batches instead of individual shovel loads.

SAY "HUFF"

PAYLOADER®

Manufactured by THE FRANK G. HOUGH CO.

NEW REFRACTORY DOES THE "IMPOSSIBLE"

Unusual properties of NORTON FUSED STABILIZED ZIRCONIA start new processing era

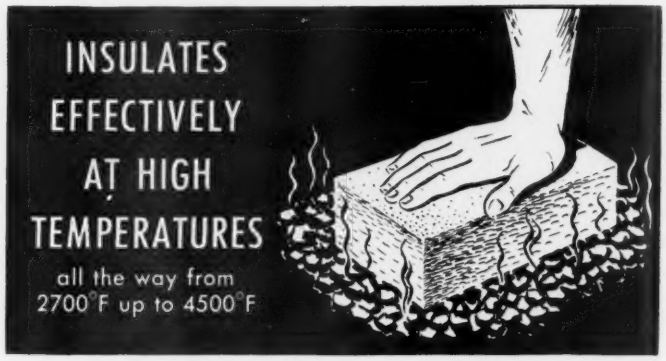
AGAIN . . . Norton Research opens the doors to new technical advances in the processing field. First to produce Fused Stabilized Zirconia in commercially significant quantities, Norton now makes it possible for you to lift your process-temperature ceiling up to 4500°F.

Extraordinary properties

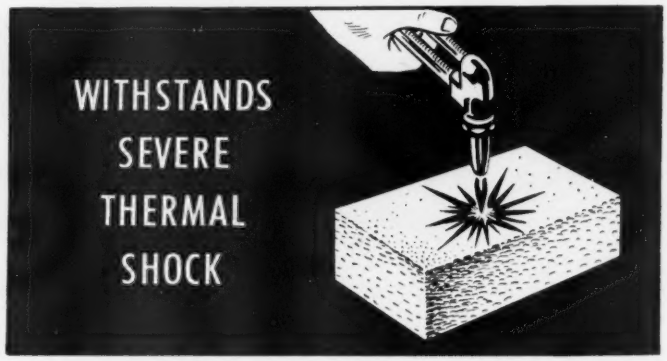
No other refractory offers such an unusual combination of properties. *Resistance to high temperature* comes first, of course. But look at its *low thermal conductivity* . . . surprising because of its relatively heavy weight (twice fire clay's). What's more, Norton Stabilized Zirconia insulating grain has a thermal conductivity of only 3 Btu. Consider, too, its *great strength* at elevated temperatures . . . its ability to *resist oxidizing and reducing atmospheres at high temperatures* . . . its *chemical inertness* in contact with titanates. Even more amazing is the *electrical resistivity* of Norton Fused Stabilized Zirconia . . . ranging from 2300 ohm-cm. at 1300°F down to 0.37 ohm-cm. at 4000°F. Resistance furnace operators take notice.

WRITE FOR DATA. In Technical Bulletin SZ1, Norton researchers and refractory engineers give you all the up-to-the-minute facts about Fused Stabilized Zirconia. Get your copy . . . use the coupon below today.

HIGHLY REFRACTORY, Norton Stabilized Zirconia has successfully speeded up gas synthesis production by permitting operating temperatures as high as 4500°F. Resists *all* oxidizing atmospheres and *most* reducing atmospheres.



LOW THERMAL CONDUCTIVITY of Norton Stabilized Zirconia brick of 6 Btu compares well with 3000°F insulating brick's 6+, fire clay's 12, alumina's 20 and silicon carbide's 50+ (approximate values at 2700°F).



GOOD THERMAL SHOCK RESISTANCE of Norton Stabilized Zirconia to extreme temperature gradients and rapid thermal changes offers interesting new possibilities in all processing industries where high temperature is a factor.

NORTON COMPANY
302 New Bond St., Worcester 6, Mass.

Gentlemen:
Please send me without obligation, Technical Bulletin SZ1 on Norton Fused Stabilized Zirconia. I'm interested in investigating its use for:

- ☐ Lining Furnaces or Reactors
- ☐ Batts for Firing Titanates
- ☐ Metal Melting
- ☐ Electric Heater Elements
- ☐ Thermal Insulation (Other applications).....

Name.....

Title.....

Company.....

Address.....

City.....Zone.....State.....

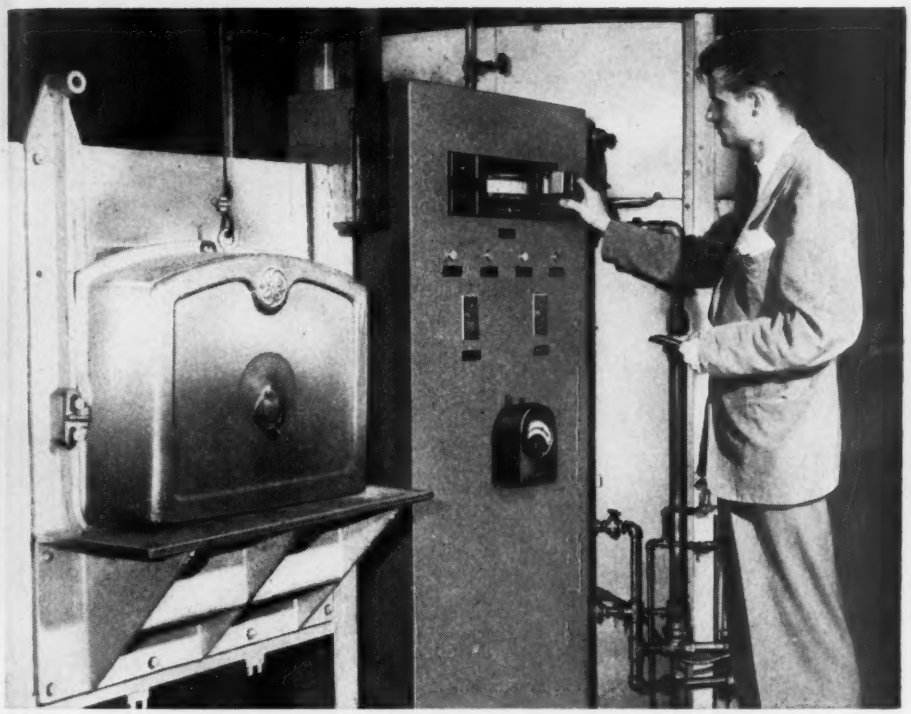
NORTON
TRADE MARK REG. U. S. PAT. OFF.

Making better products to make other products better

Special REFRACTORIES

Canadian Representative
A. P. GREEN FIRE BRICK CO., Ltd. TORONTO, ONTARIO

PRESENTING . . . THE NEWEST IN PROCESS TEMPERATURE CONTROL



This General Electric Type HP-3 Pyrometer controls a ribbon-resistor box furnace.

PYROMETER EQUIPMENT

With the introduction of this completely new line of Pyrometer Equipment, General Electric offers you accurate indication and temperature control of furnaces, ovens, kilns, and other industrial-heating equipment.

ACCURATE INDICATION. Calibrated accuracy is within ¾ of 1 per cent of full scale. Automatic cold-junction compensation assures that changes in ambient temperature will not appreciably affect accuracy.

CLOSE TEMPERATURE CONTROL. Any change in temperature equivalent to 1/10 of 1 per cent of full scale starts immediate control action. Normal changes in humidity, ambient temperature, and voltage have little or no effect on the exactness of control action.

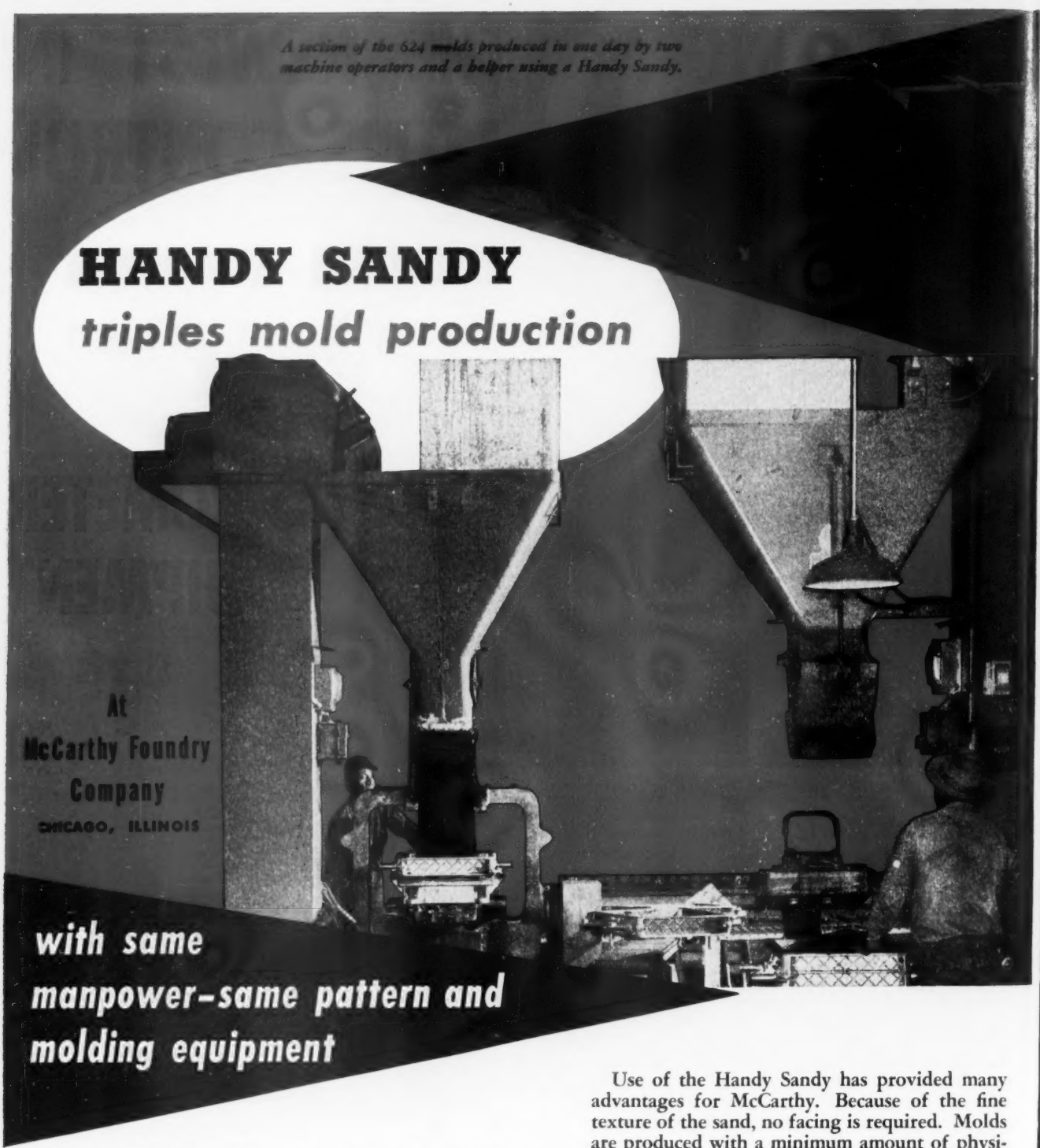
DEPENDABLE OPERATION. Substantial industrial components and strong construction throughout make G-E pyrometers exceptionally rugged. A 3¼-pound alnico magnet provides high flux density and allows large air gaps; lightweight moving system has high resistance to shock and vibration.

For more details, get in touch with your nearest General Electric representative, or write for Bulletin GEA-5534, "G-E Pyrometer Equipment." Apparatus Dept., General Electric Company, Schenectady, N. Y.

General Electric's pyrometer line consists of flush- or surface-mounted indicators, controllers and protectors. Shown above is Type HP-3 two-position indicating controller. A three-position controller is also available.

GENERAL ELECTRIC

602-198



Simply by taking the shovel out of the Molder's hand and replacing it with a Handy Sandy, McCarthy Foundry tripled their mold production. They still use the same pattern and molding equipment. Yet two machine operators and a helper have produced 624 molds in a single day using the Handy Sandy . . . compared to a maximum of 200 molds when filling the flasks by shoveling. This production is obtained on molds using a 20" x 20" pop-off flask. They have a mold height of 10" with a 6" cope and a 4" drag.

Use of the Handy Sandy has provided many advantages for McCarthy. Because of the fine texture of the sand, no facing is required. Molds are produced with a minimum amount of physical effort. The increase in production has made possible faster deliveries — a factor that has won new business for McCarthy and has improved their service to present customers as well.

Yes, the Handy Sandy eliminates "shovel-fatigue" and lets the molder devote full time to producing molds. Your investment in equipment and labor brings you a greater return.

See how the Handy Sandy can multiply your mold production and save you costly expenditures for new patterns, manpower and molding equipment. Write today for complete details.

NEWAYGO | ENGINEERING COMPANY

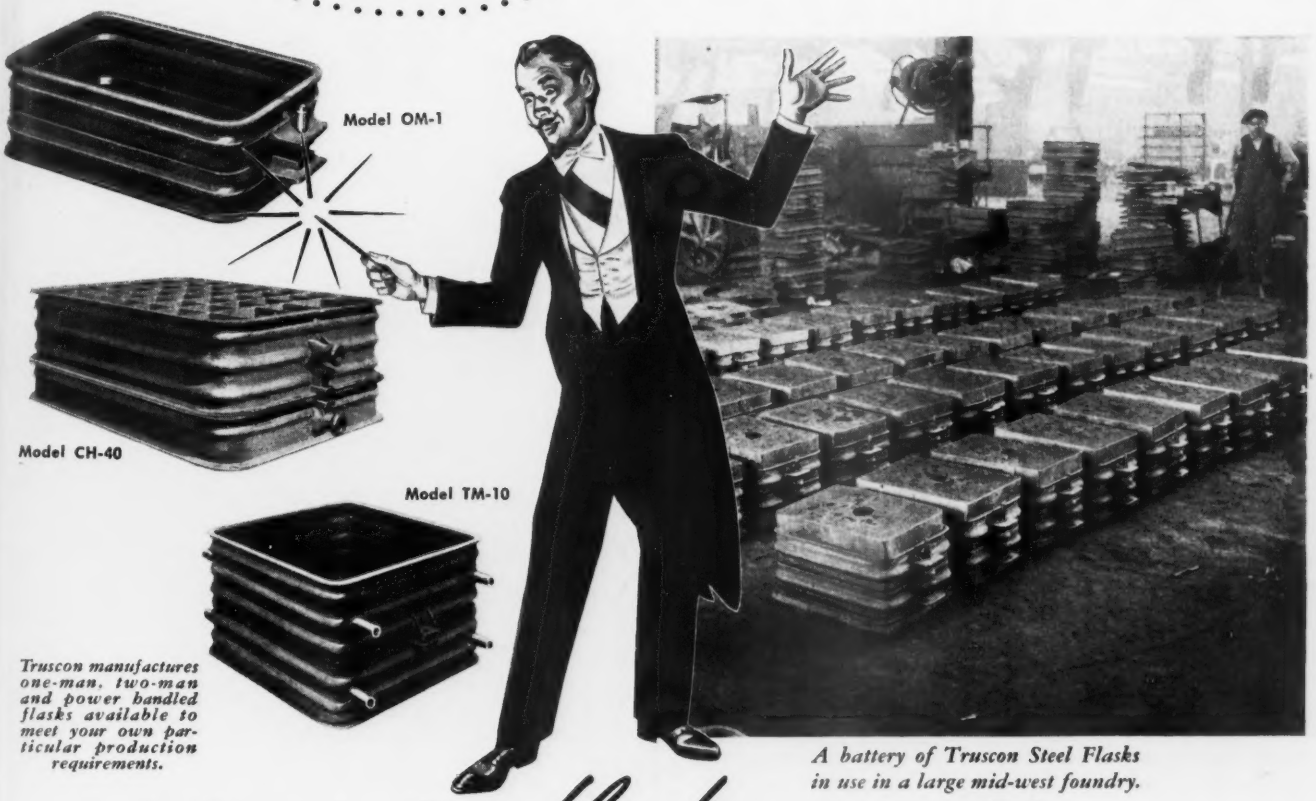
NEWAYGO, MICHIGAN

Manufacturers of Neway Mold Handling, Sand Handling and Conditioning Equipment.

TRUSCON
MARK OF MERIT PRODUCTS

TRUSCON STEEL FOUNDRY FLASKS

just say "*Truscon*"...



Truscon manufactures one-man, two-man and power handled flasks available to meet your own particular production requirements.

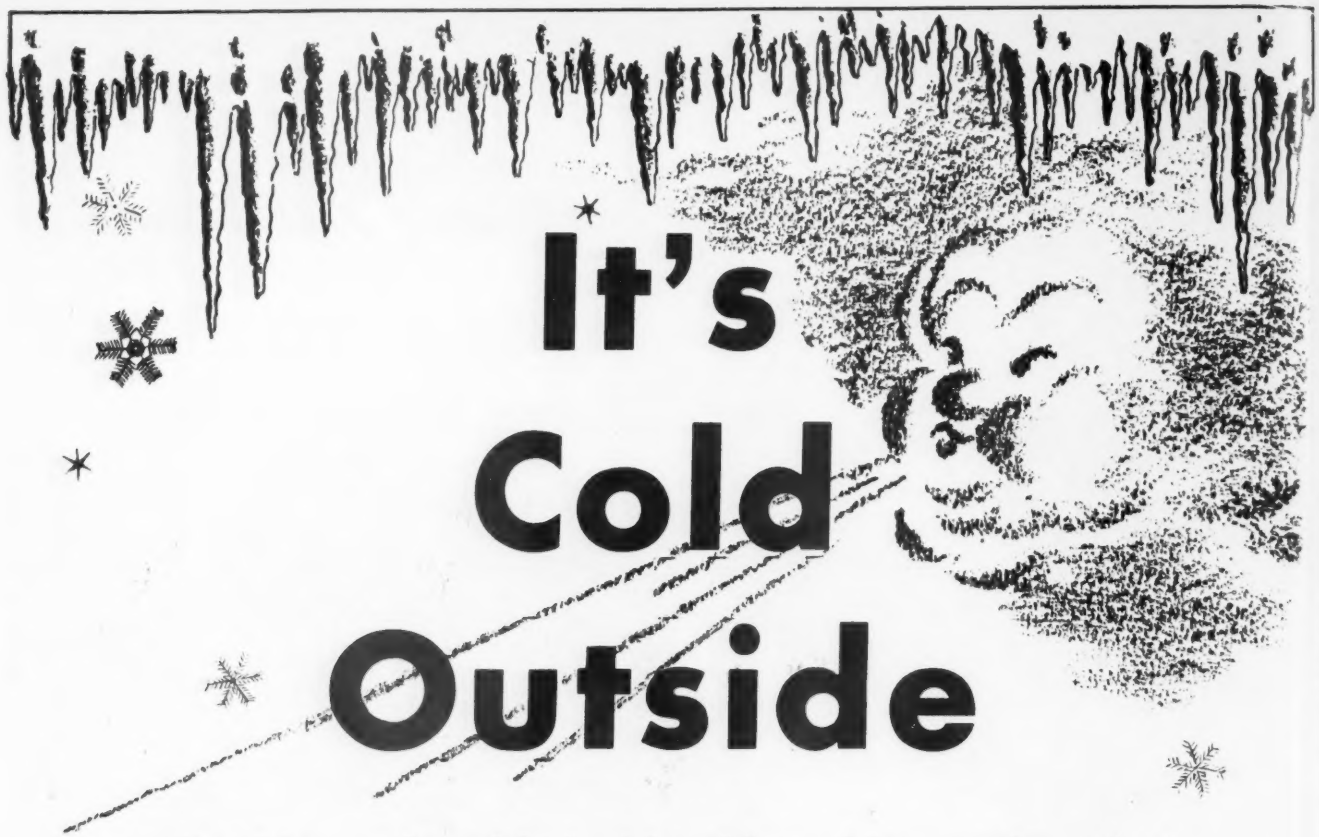
A battery of Truscon Steel Flasks in use in a large mid-west foundry.

and there's the *flask* you need!

Truscon has scores of different types of flasks to meet a wide range of foundry requirements. And if your needs are something special, Truscon has the engineering ability to tailor-make the exact units you require. Truscon's long experience in flask design . . . Truscon's highly efficient facilities for flask production and service . . . Truscon's long association with flask users in every branch of the foundry industry . . . these are *plus* features that make your dollar investment in Truscon Steel Foundry Flasks so much more profitable. Write for catalog showing wide range of Truscon Steel Flasks available, and ask for an experienced Truscon foundry man to help plan your needs efficiently.

TRUSCON STEEL COMPANY

PRESSED STEEL DIVISION • 6202 TRUSCON AVENUE • CLEVELAND 4, OHIO
SUBSIDIARY OF REPUBLIC STEEL CORPORATION



It's Cold Outside

But it's comfortable inside of foundries equipped with Schneible Compensating Air Uni-flo Ventilation Hoods that reduce the exhaust of warm air from the building up to 75%. Save your valuable warm plant air and save money.

CLAUDE B. SCHNEIBLE COMPANY
P. O. BOX 502, ROOSEVELT ANNEX
DETROIT 32, MICHIGAN

Please send me your new bulletin 450 without obligation.

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

SCHNEIBLE

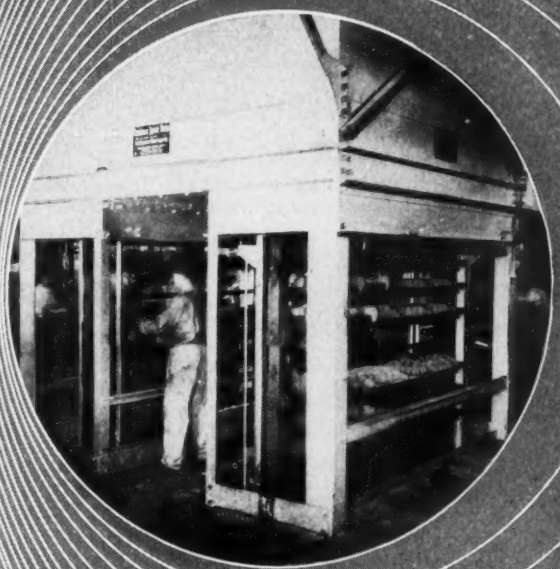
FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

USE "TRULINE" TO

Speed Baking Cycles

IN YOUR TOWER OVEN

—cut time for "one-trip" cores
—cut number of trips for large cores



MANY foundrymen using Tower or other conveyor-type ovens have found that "Truline" Binder promotes faster baking, speeds up core making two ways. First, small cores requiring only one trip through the oven are baked faster. Second, by replacing core oil with "Truline" Binder, large or chunky cores put through with smaller ones often need only one cycle to bake thoroughly. And large cores, formerly requiring three trips when baked along with "one-trip" cores can now be completely baked in two trips through the oven. Moreover, when cores require more than one cycle, there is no danger of disintegration.

HERCULES POWDER COMPANY
INCORPORATED
920 King Street, Wilmington, Del.

HERCULES

TRULINE
REG. U.S. PAT. OFF.
BINDER

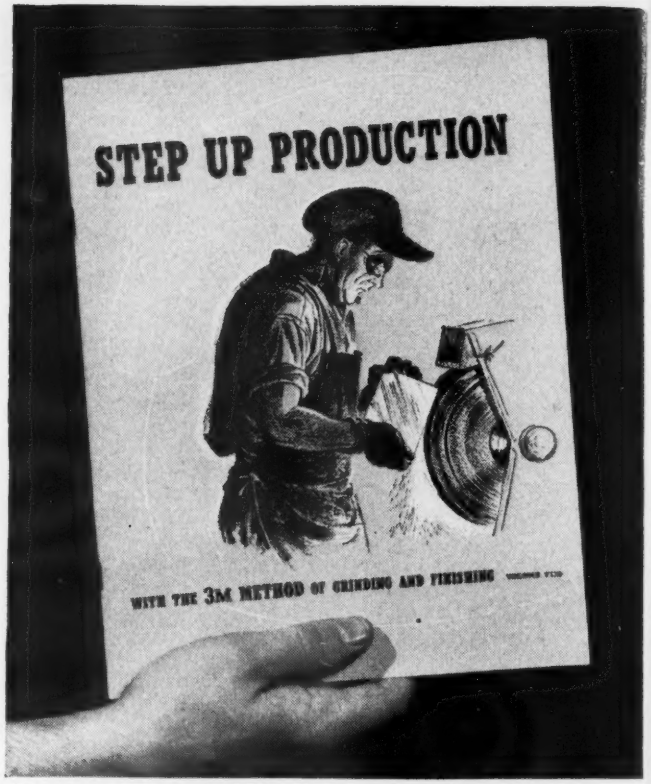
NF51-1

NEW BOOK

Shows how to cut grinding and finishing costs

Copies now available . . . . . yours for the asking

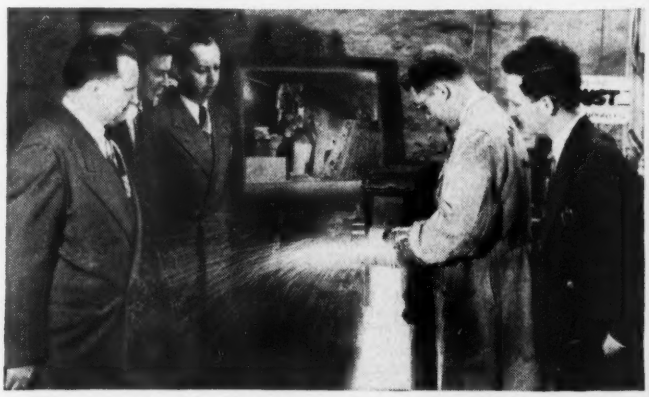
This new booklet covers the subject of industrial grinding and finishing from all angles, through a series of "case histories" taken straight from the production line. Here's the aggregate of 3M's practical experience with belt grinding installations. 36 picture-filled pages showing how to step up your output and cut your unit cost by converting your present equipment to the 3M Method of Grinding and Finishing. Send for your FREE copy today!



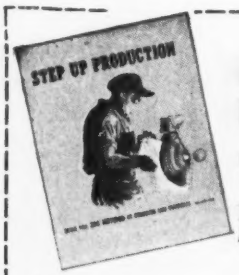
$20,000 SAVED IN ONE YEAR . . . 3-step operation cut to one . . . equipment pays for itself in thirty days! These are samples of the results cited in this new 36 page brochure covering the subject of grinding and finishing with 3M Belts.

READ "CASE HISTORIES" COVERING:

- Foundry grinding
- Aluminum grinding and finishing
- Grinding and finishing brass and bronze
- Cold rolled steel grinding and polishing
- Grinding forged and heat-treated steel
- Sanding and smoothing woods and plastics
- Pre-finishing of steel in the flat
- Stainless steel grinding and polishing
- Polishing tubing inside and outside
- Grinding and seaming glass



FREE BOOK tells about 3M's plant survey service. Learn how you can convert present equipment to the 3M System of Grinding and Finishing. Send for your FREE copy today.



MAIL THIS COUPON TODAY FOR YOUR FREE COPY OF "STEP UP PRODUCTION"

MINNESOTA MINING & MFG. CO.,
St. Paul 6, Minn. F-251

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Address .....

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Made in U.S.A. by MINNESOTA MINING & MFG. CO., St. Paul 6, Minn., also makers of "Scotch" Brand Pressure-sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Adhesives.

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Increase Customer Satisfaction

with APEX Products

- **ALUMINUM ALLOYS** — *for all types of castings*
- **ALUMINUM** — *for steel deoxidizing and grain control*
- **ALUMINUM BASE HARDENERS** — *for alloying and grain refining purposes*
- **GRAINED ALUMINUM** — *for thermit reductions, steel metallurgy, chemical applications, etc.*
- **ALUMINUM FLUXES** — *for cleansing and grain refining all alloys*
- **MAGNESIUM ALLOYS** — *for all types of castings*
- **MAGNESIUM ANODES** — *for cathodic protection*
- **ZINC ALLOYS** — *for die castings and metal forming dies*

In the Apex laboratories, Apex research and facilities are devoted to producing *better* ingot, analyzing particular problems for foundries who use *all* methods of castings—sand, permanent mold or die casting. Thus, Apex maintains always this high standard: "Best in every test from Ingot to Casting!"

TECHNICAL SERVICES

Spectrographic standards . . . Chemical analytical methods . . . Physical and mechanical property tests . . . Chemical, quantometer and spectrographic analyses . . . Field engineering.

Apex Smelting Company

2837 WEST TAYLOR STREET • CHICAGO 12, ILLINOIS
6700 GRANT AVENUE • CLEVELAND 5, OHIO

for FLOOR STANDS

for SWING FRAMES

for PORTABLES

Making better products to make other products better

Select Wheels with exactly the *Right Combination* of *Cutting Action* and *Wheel Life* for MAXIMUM ECONOMY

Select NORTON Grinding Wheels

NO matter what combination of cutting action and length of wheel life you require for maximum economy on *your* particular snagging jobs, Norton Company, with its research facilities, engineering skill and wide product variety, can fill your requirements.

FAST CUT

If "fast cut" is the primary requirement which spells economy on your snagging operations, you'll find a Norton wheel with exactly the right abrasive and bond combination to fill the bill.

LONG LIFE

If "long life" is your particular requirement for economy, Norton abrasive know-how can help you to select exactly the right grinding wheels.

PRODUCT VARIETY

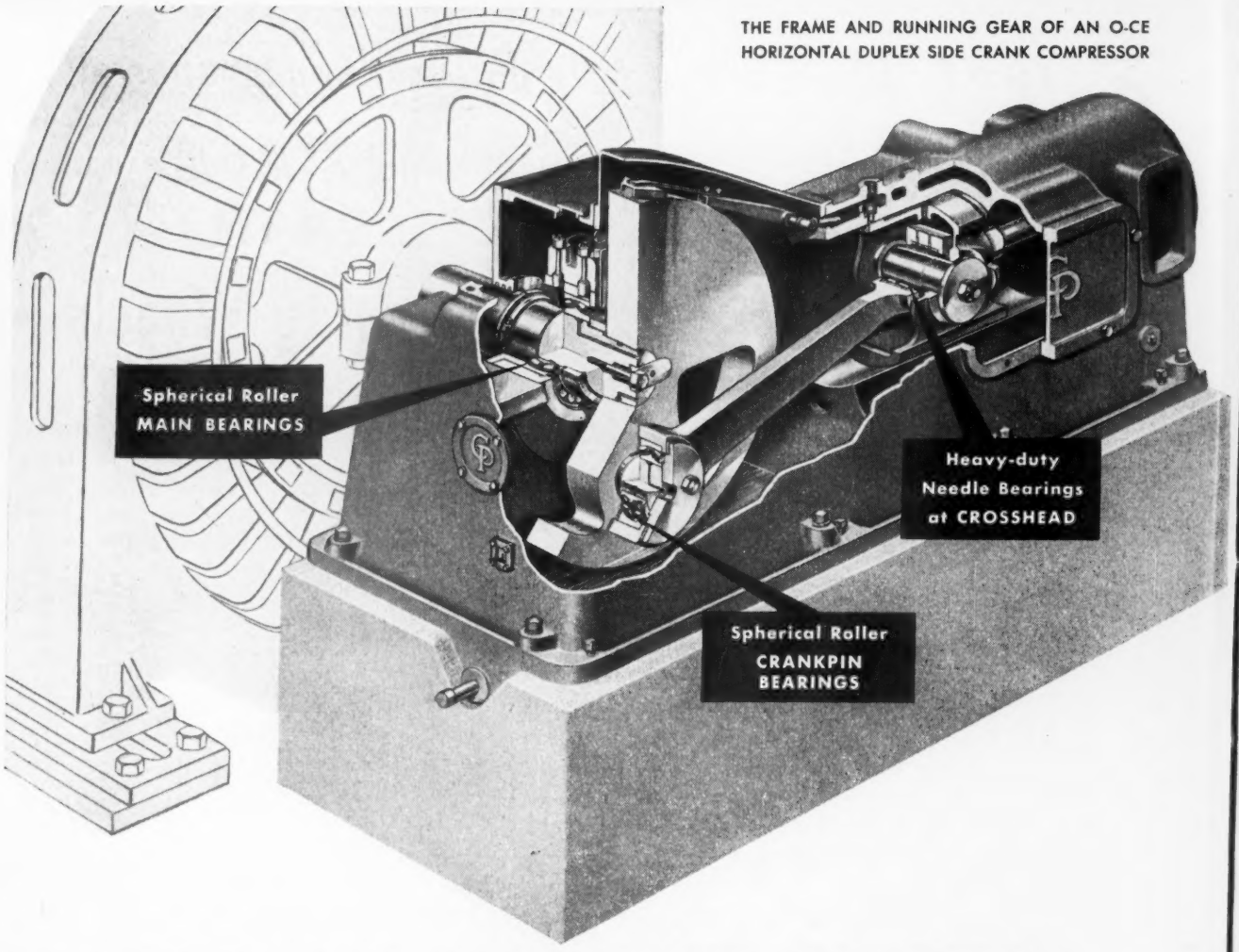
Norton wheels for snagging operations are available with ALUNDUM, 15 ALUNDUM, 57 ALUNDUM and CRYSTOLON abrasives; with B-5, B-7 and BH resinoid bonds and vitrified bond.

You'll find many helpful rough grinding tips and scores of cost-cutting wheel specifications in the Norton booklet, "Rough Grinding." Send for your copy of Form 1405-Al.

NORTON ABRASIVES

NORTON COMPANY, WORCESTER 6, MASS. · Warehouses in Five Cities · Distributors in All Principal Cities

THE FRAME AND RUNNING GEAR OF AN O-CE HORIZONTAL DUPLEX SIDE CRANK COMPRESSOR



CP SELF-ADJUSTING ROLLER BEARINGS reduce compressor maintenance

The use of roller bearings in the running gear of CP horizontal duplex compressors eliminates all chance of misadjustment in maintenance. Since the bearings are self-adjusting, no running-in time is needed, there are no bearing knocks, and replacement should never be required.

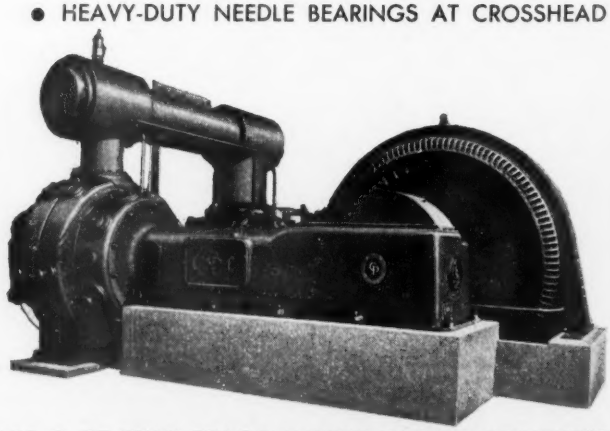
The use of spherical roller main bearings and crankpin bearings, and heavy-duty needle bearings at the crosshead pins, is made possible by the recent development of the oil injection method of bearing and crank disc installation and removal. This method is so simple that it requires only a hand-operated oil pump and ordinary hand tools.

A further advantage of roller crankpin bearings is that they permit the use of solid-end connecting rods — the strongest and safest type.

Class O-CE Motor-driven Compressors are furnished in sizes up to 2000 h.p.

Write for Bulletin 726-5

- SPHERICAL ROLLER MAIN BEARINGS
- SPHERICAL ROLLER CRANKPIN BEARINGS
- HEAVY-DUTY NEEDLE BEARINGS AT CROSSHEAD



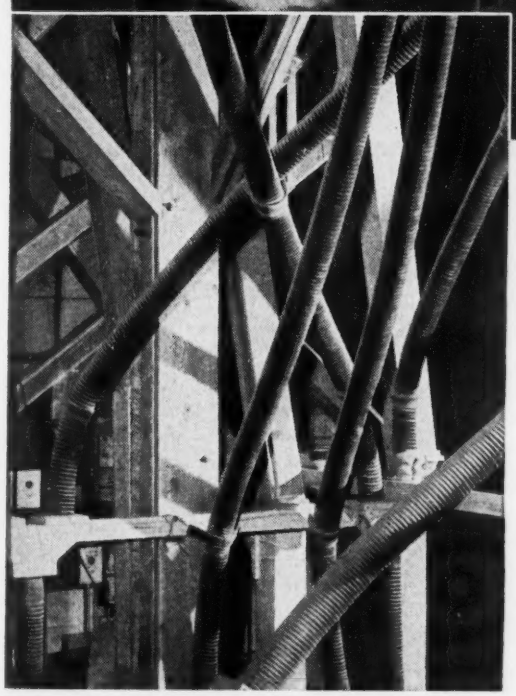
CLASS O-CE TWO-STAGE MOTOR-DRIVEN COMPRESSOR

CHICAGO PNEUMATIC TOOL COMPANY
General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

U. S. RAINBOW SANDBLAST HOSE employs compounds which prevent static electricity caused by the blasting materials passing through the hose. Tube is ¼-inch minimum thickness for top abrasion resistance. Flexible, kink-resistant body.

What's U. S. Rubber doing with Sand and Dust?



U. S. DUST CONVEYING HOSE will withstand the severe action of various abrasive particles conveyed through blower or suction systems. Exceptionally light and flexible. Resistant to fumes and moisture.

"U. S." technicians are constantly developing new types of hose to meet new specifications, new conditions in conveying sand and dust.

When you specify U.S. Rubber Hose, you may be sure that your investment will bring you the maximum return in trouble-free performance, in operating life and in economical service.

The research and design staff of United States Rubber Company is always at your service on hose problems. Write to address below.

PRODUCTS OF

U.S.RUBBER

SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

THIS MONTH, 62,562* BUYERS OF CASTINGS WILL READ THIS AD...

This is one of a series of 6 full page ads emphasizing the expanding industrial acceptance of Brass Castings. Nationally circulated in outstanding trade journals and read by manufacturers, engineers, contractors, metallurgists, production control men—*these messages reach the men who specify and influence the purchasing of castings!*

R. Lavin & Sons, Inc.

PUMP MANUFACTURERS SPECIFY BRONZE

Because of Its Resistance to Corrosion... Pressure Tightness and Anti-Frictional Characteristics

Bronze pumps are used in every phase of modern civilization. Pumps are required to convey corrosive liquids in industry, sea water in our navy's ships, water in fire extinguishing equipment and waste in sewage disposal systems. Pressure tightness, resistance to corrosion, strength, ductility and anti-frictional characteristics are some of the qualities required of pump materials. Wherever liquids are used...*in home or in industry*...pumps with essential Bronze parts play a vital role.

Specify—LAVIN NON-FERROUS INGOT—*Quality*

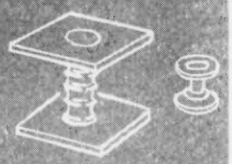
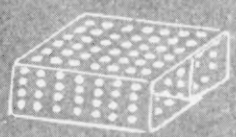
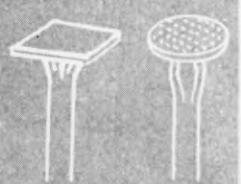
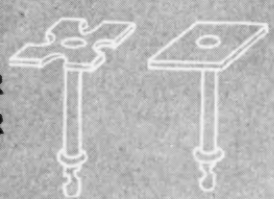
R. LAVIN & SONS, INC.
Refiners of Brass, Bronze and Aluminum
3426 SOUTH KEDZIE AVENUE • CHICAGO 23, ILLINOIS
REPRESENTATIVES IN PRINCIPAL CITIES

REPRINTS OF ENTIRE *Brass Castings* SERIES ARE YOURS FOR THE ASKING

The Foundryman's Problems . . . Are Our Problems!

* Audited Circulation plus pass-on readership.

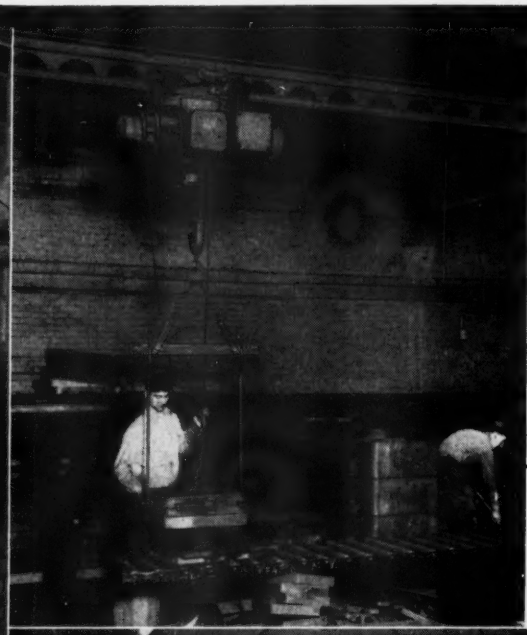
FANNER, and only FANNER, Makes All These Chaplet Types

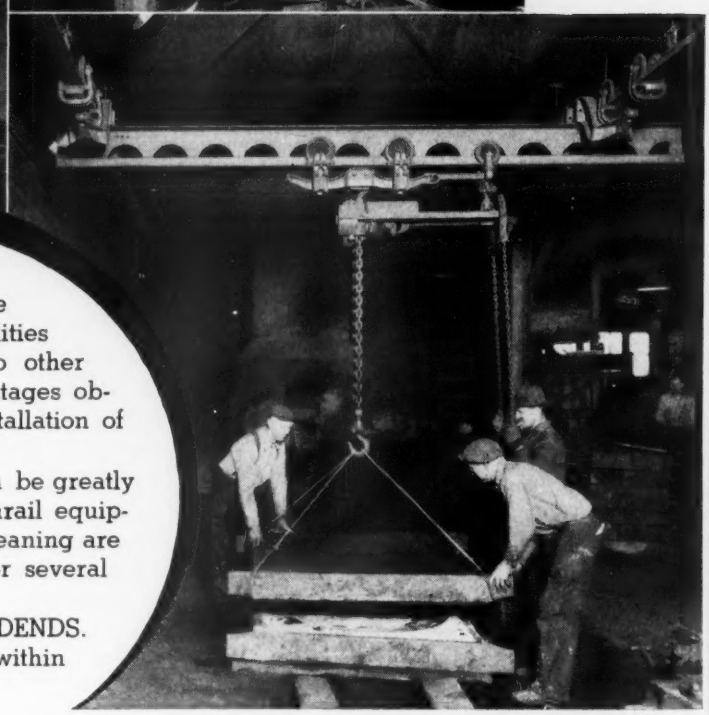
TYPE	CHARACTERISTICS	APPLICATIONS
MOTOR 	FUSE READILY STEMS CAN BE GROOVED HEADS CAN BE PERFORATED CLOSE TOLERANCES ± .002 HEADS CAN BE TILTED	*For Light Sections of* Motor Blocks • Heads • Housings Radiator Sections • Burner Sections • Pump Sections • Farm Equipment • Job Castings
BUTTON HEAD OR BOILER	STURDY STRUCTURE FUSE READILY STEMS CAN BE GROOVED NON SLIP BUTTON HEAD	*For Boiler Sections*
PERFORATED 	10 STANDARD SHAPES MADE TO FIT ALL CONTOURS MADE TO ALL RADII DESIGNED FOR WEDGES LOW IN COST	*For Light Sections of* Stove Castings • Motor Castings Job Castings
DOUBLE HEAD	STURDY STRUCTURE STRONG SUPPORT TO CORE CLOSE TOLERANCES ± .005 STEMS CAN BE GROOVED HEADS CAN BE CANTED	*For Heavy Sections of* Machine Tool Bases • Diesel Engines • Locomotive Frames Side Frames • Pumps • Road Machinery
SINGLE HEAD 	NON-SLIP FORGED HEADS FITTED HEADS WITH ANY RADIUS SOLID SUPPORT	*For Very Heavy Cores of* Diesel Engines • Machine Bases
RADIATOR	UNIFORM BREAK-OFF NICKS DEEP NICKS FOR FIRM KNITTING LOW COST	*For Radiator Sections*
SHOULDER RADIATOR 	EASY TO PLACE FUSE READILY DEEP BREAK-OFF NICKS STAGGERED NICKS FOR FIRM KNITTING UNIFORM SHOULDERS	*For All Thin Sections of* Manifolds • Stove Burners Cylinder Heads

FANNER MFG. CO., CLEVELAND 1, OHIO

In Canada: CANADIAN FANNER, LTD., Hamilton, Ont., Canada

SPEED MOLD-MAKING
the efficient Cleveland Tramrail Way





Wherever materials of any kind in a foundry are lifted, moved or handled, there usually are possibilities for effecting important economies. Probably in no other way can so much be saved and as many advantages obtained for such a small investment as through installation of proper materials handling equipment.

Mold-making is one of the many jobs that can be greatly eased and speeded with overhead Cleveland Tramrail equipment. Pouring, sand-handling, cupola-charging, cleaning are others. Often the same equipment can be used for several different purposes.

Cleveland Tramrail pays dividends — BIG DIVIDENDS. Most installations pay for themselves out of savings within one year; some in less than six months.

GET THIS BOOK!
BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
3806 East 286th St. Wickliffe, Ohio.

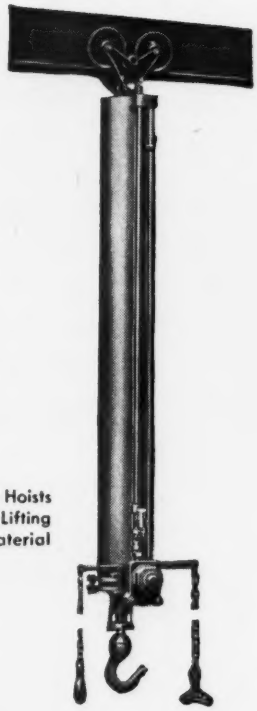
CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT

IT'S IMPORTANT

To SAVE MAN HOURS
REDUCE PRODUCTION COSTS
INCREASE PLANT EFFICIENCY

That's Why It Will Pay You to Investigate

CURTIS AIR COMPRESSORS AIR-OPERATED CYLINDERS & HOISTS



Curtis Vertical Air Hoists Provide Low-Cost Lifting or Lowering of Material or Machines.

Curtis Model F Air Compressors are available as either electric or gasoline motor-driven units (electric motor-driven portable or stationary). Up to 10 H.P.

Model C Water-Cooled Compressors, up to 50 H.P. Fully Enclosed — Dust and Dirt Proof — Carbon-free Valves. Timken Bearings.

Curtis Horizontal Air Cylinders for almost any Pushing, Pulling or Hoisting Operation.

I-51-1

Throughout the world, Curtis equipment has stood the test of time, because it is precision made from top quality raw materials with 97 years of "know how."

CURTIS PNEUMATIC MACHINERY DIVISION
of Curtis Manufacturing Company
1922 Kienlen Ave., St. Louis 20, Mo.

I am interested in items checked below:

☐ **AIR HOISTS**
Stroke? ☐ Capacity? ☐

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Capacity? ☐ Pressure? ☐
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Name.....

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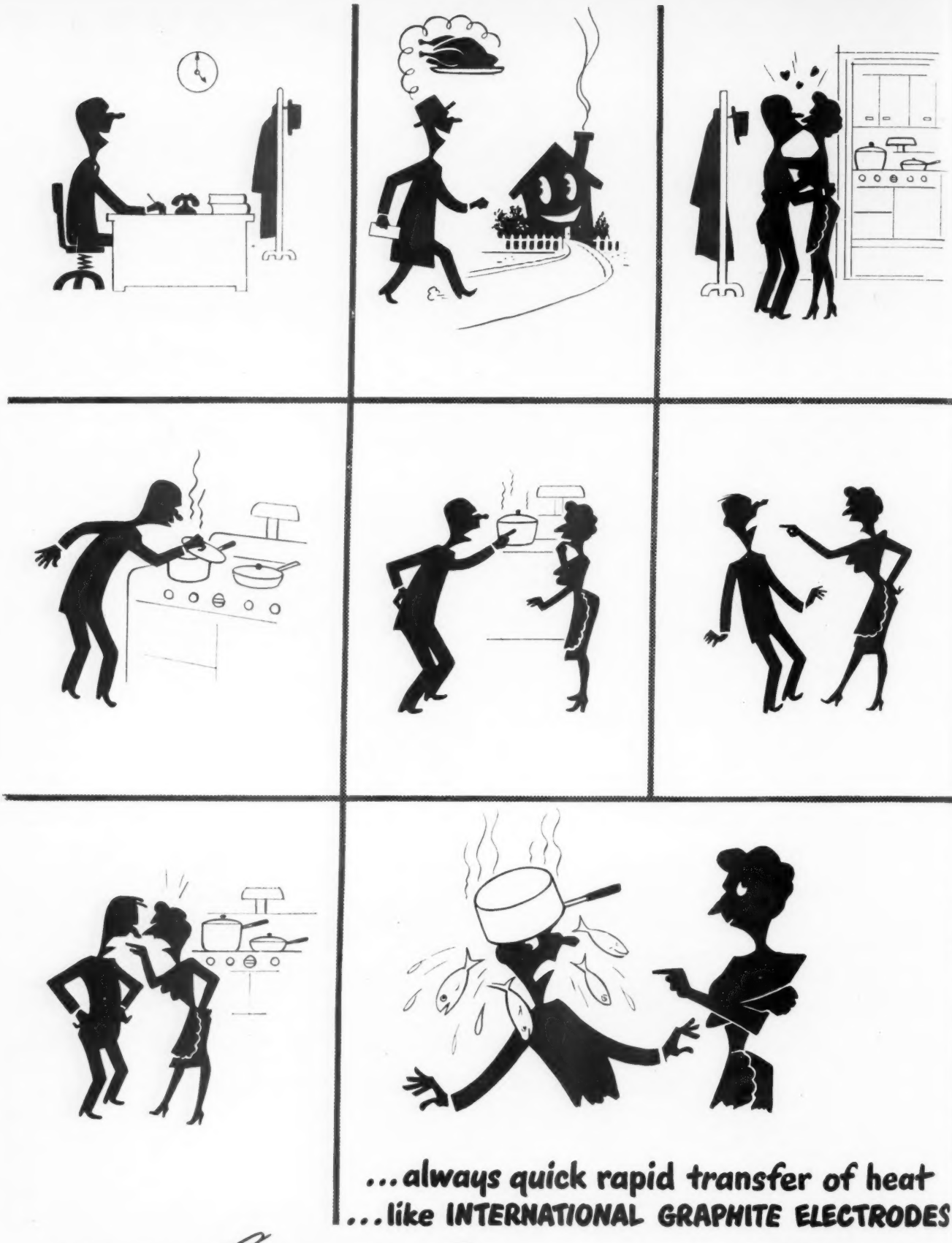
City.....Zone.....State.....



...always quick rapid transfer of heat
...like INTERNATIONAL GRAPHITE ELECTRODES

INTERNATIONAL *Graphite & Electrode* **CORP.**

A SPEER CARBON COMPANY SUBSIDIARY

ST. MARYS, PENNSYLVANIA

VOLCLAY Bentonite

No better testimony than your gratifying words:

"Repeat Order"

As we look over the list of customers who bought the hundreds of carloads of Volclay Bentonite shipped in 1950, we see that nearly all of them are firms who have used it steadily for 5, 10, 20 years and longer. Some began to use Volclay in 1927 and have bought it every year since.

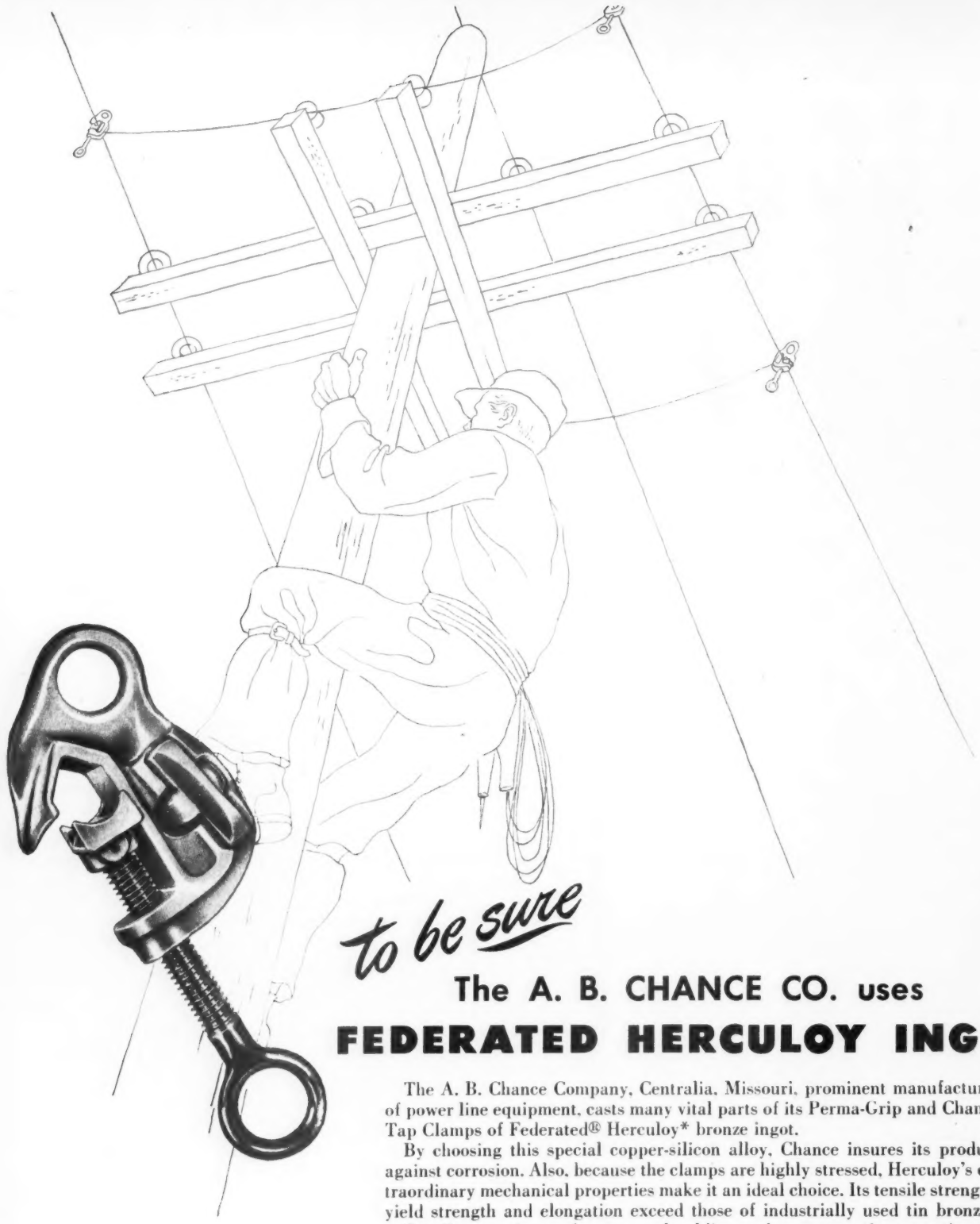
There is a deep satisfaction in having a material which has been so steadily used by foundries, chemical plants and process industries whose finished products rank among the nation's best.

Every time you say "Repeat Order" you add another recommendation for Volclay, the bentonite which has been industry's standard of quality since 1927.

Produced by

American Colloid Company

Merchandise Mart Plaza • Chicago 54, Illinois



to be sure

The A. B. CHANCE CO. uses

FEDERATED HERCULOY INGOT

The A. B. Chance Company, Centralia, Missouri, prominent manufacturer of power line equipment, casts many vital parts of its Perma-Grip and Chance Tap Clamps of Federated® Herculoy* bronze ingot.

By choosing this special copper-silicon alloy, Chance insures its product against corrosion. Also, because the clamps are highly stressed, Herculoy's extraordinary mechanical properties make it an ideal choice. Its tensile strength, yield strength and elongation exceed those of industrially used tin bronzes.

Excellent casting surface, ease of welding and non-magnetic properties are other characteristics of Herculoy which make it fully suitable for the A. B. Chance product.

The advantages of Herculoy bronzes are numerous. Some of them could mean better castings for you. Learn more about Herculoy in a free booklet offered by Federated. Write today for your copy.

**Registered Trade Mark of Revere Copper and Brass, Incorporated*

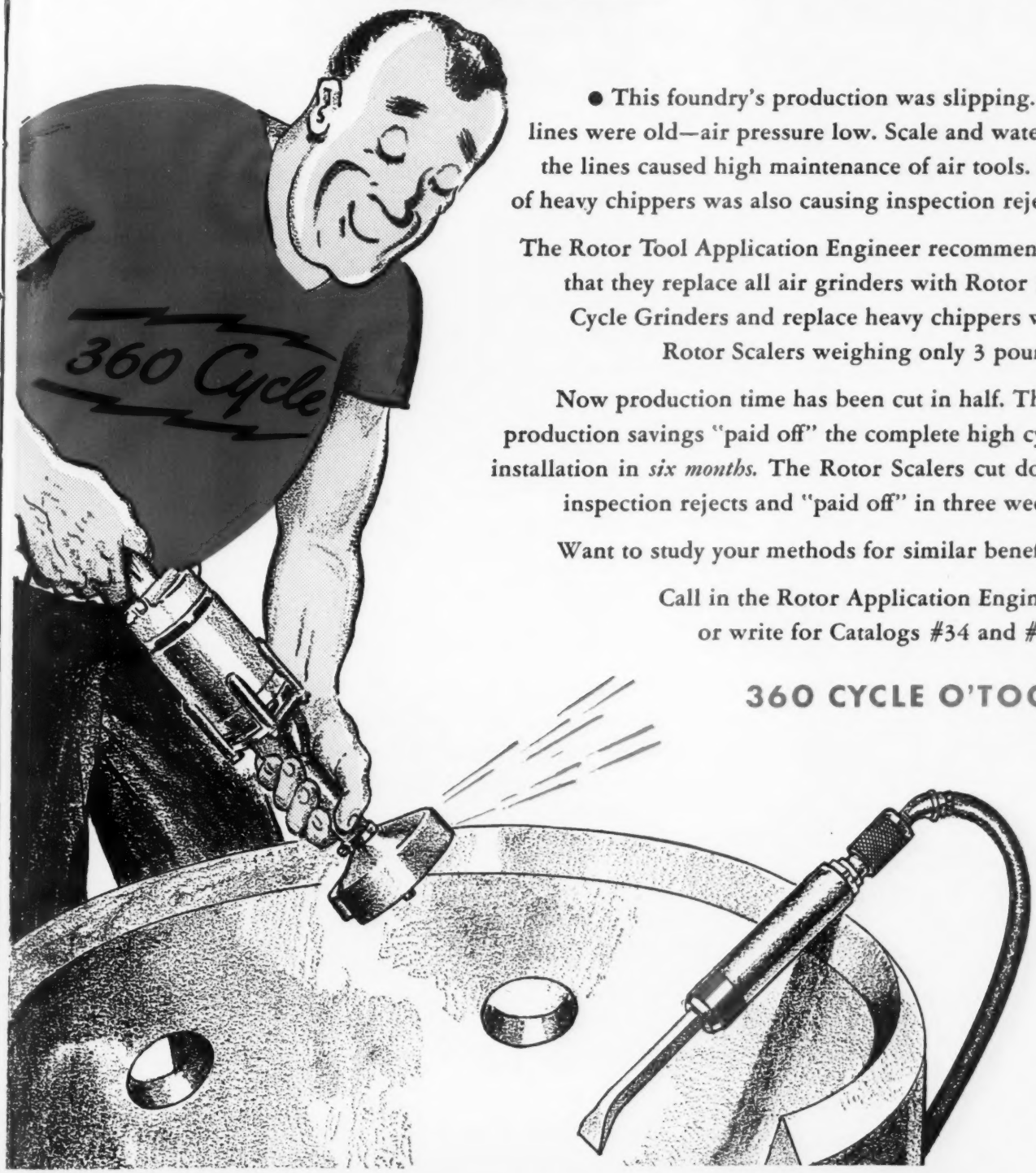
Federated Metals Division

federated first in the non-ferrous field FMD

AMERICAN SMELTING AND REFINING COMPANY • 120 BROADWAY, NEW YORK 5, N. Y.

CASTINGS CLEANED IN ½ THE TIME

ROTOR TOOLS "PAID OFF" IN 6 MONTHS!



● This foundry's production was slipping. Air lines were old—air pressure low. Scale and water in the lines caused high maintenance of air tools. Use of heavy chippers was also causing inspection rejects.

The Rotor Tool Application Engineer recommended that they replace all air grinders with Rotor 360 Cycle Grinders and replace heavy chippers with Rotor Scalers weighing only 3 pounds.

Now production time has been cut in half. These production savings "paid off" the complete high cycle installation in *six months.* The Rotor Scalers cut down inspection rejects and "paid off" in three weeks.

Want to study your methods for similar benefits?

Call in the Rotor Application Engineer or write for Catalogs #34 and #37.

360 CYCLE O'TOOL

AN UNUSUAL FORMULA...

$x + y = ?x \text{ or } ?y$

YOUR COMPANY is "x" and our organization is "y." Now add the broad, general experience of our engineers to the specific foundry operating knowledge of your personnel. How much more effective is this combination working together toward the solution of your problems than either group would be alone? Many times—because it has been proven that adding our professional foundry engineers temporarily to a foundry staff is the *simplest, most efficient, most economical* way to solve that foundry's problems!

AND AN UNUSUAL ORGANIZATION...

KNIGHT Services For Foundries:

- Foundry Engineering
- Architectural Planning
- Foundry Layout
- Foundry Modernization
- Foundry Management
- Industrial Engineering; Job Evaluation, Incentives
- Production and Cost Control

LESTER B. KNIGHT & ASSOCIATES, INC., is an organized group of professional foundry engineers—unusual in that specialists in every phase of foundry operation, layout, methods, procedures, management, incentives, etc., are available to pool their experience toward the very best solution of your foundry problems—no matter how large or small. A complete architectural and engineering service is also available. Many foundries have used Knight Services to excellent advantage to modernize the plant and improve methods, operations and profit.

Send for Booklet

"Knight Service for Wage Payment and Cost Controls" outlines a simple, effective system for wage incentives, cost and labor control.

LESTER B. KNIGHT & ASSOCIATES, INC.

Member of the Association of Consulting Management Engineers, Inc.

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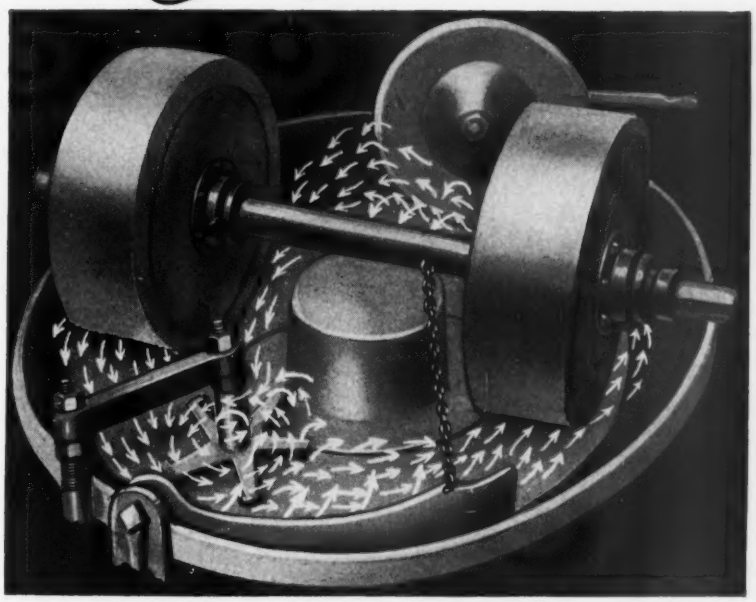
CONSULTING SERVICE: Management, Sales, Production — ENGINEERING SERVICE: Surveys, Modernization, Mechanization
PLANT AND ARCHITECTURAL ENGINEERING

THE *Clearfield* MIXER

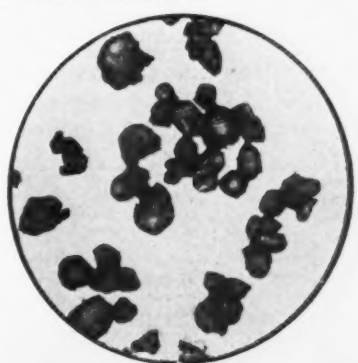
prepares better foundry sand



Foundry sand is composed of three principal elements, silica grains, bond and moisture. The quality of this sand depends in major part upon how well these three elements are blended. Therein lies the explanation of the outstanding performances of Clearfield Mixers.

Clearfield Mixers employ the revolving pan principle of sand preparation. The mullers are mounted on a floating shaft and revolve by contact with the moving sand. Centrifugal force together with the stirring action of the agitator and disc transform the sand from an inert mass into a fluid moving stream. The result is a perfect blend of the three elements—and foundry sand that does its job perfectly.

There's a Clearfield Mixer which will meet all your sand preparation needs. Write today for Catalog No. 79 for complete details.



VISUAL EVIDENCE of the effectiveness of Clearfield Mixers is provided by these photomicrographs. Above, unbonded silica sand. Below, the same sand bonded in a Clearfield Mixer.

CLEARFIELD MIXER

MIXES, TEMPERS AERATES

CLEARFIELD MACHINE COMPANY

CLEARFIELD PENNSYLVANIA, U. S. A.

Advertisement

ELECTROMET Data Sheet

A Digest of the Production, Properties, and Uses of Steels and Other Metals

Published by Electro Metallurgical Division, Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. • In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

How to Control Composition of Cast Iron With Silicon and Manganese Briquets

Control of the composition of cupola-melted cast iron becomes a simple matter through the use of alloy briquets.

These briquets make the old practice of blending two or three pig irons of high and low silicon and manganese contents, to produce a desired composition, both unnecessary and undesirable. A single grade of pig iron can be stocked, and any desired composition in the product can be obtained, simply and economically, by the addition of silicon and manganese briquets.

Function of Silicon in Iron

In cast iron, silicon acts as a deoxidizer and graphitizer. It promotes the formation of flake graphite and softens the iron.

When either the carbon or silicon content of an iron is too low for the section thickness involved, the result will be the formation of chilled spots (iron carbide) at corners and in other rapidly cooled locations. This has an adverse effect on the machinability of the iron and the life of the tools used to machine it. On the other hand, excessively high carbon or silicon content in heavier sections results in open-grained iron that is both soft and weak.

How Silicon Aids Carbon Control

A rather definite relationship exists between the silicon level in a pig iron and its carbon content, as shown in Figure 1.

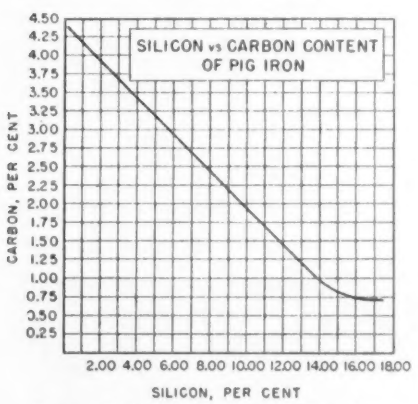


Fig. 1—Relation of silicon and carbon content in pig iron. Notice that the carbon level gradually decreases as the silicon is increased.

As indicated in Figure 1, an increase in the silicon content of a pig iron has a decided effect in lowering its carbon content. When producing soft iron, where it is desirable to hold the carbon on the high side, pig iron running in the range of 2.0 per cent silicon is desirable in the cupola charge, rather than the higher silicon grades of pig sometimes used in these irons. The additional silicon needed to meet the desired chemical analysis can be easily and economically added to the charge in the form of silicon briquets. This provides an economical and flexible system of chemical control.

Function of Manganese in Iron

Manganese acts as a scavenger to deoxidize iron. As an alloying element, it imparts density and high strength. It combines with sulphur to form manganese sulphide, which does not have the harmful characteristics of the iron-sulphide inclusions that form when manganese is not present. A manganese-sulphur ratio of 6:1 is suggested.

Briquets Give High Alloy Recovery

Silicon and manganese briquets are manufactured by ELECTROMET in the sizes shown in Table I. These "EM" briquets are all made with a binder that prevents oxidation until the alloy unites with the iron in the melting zone of the cupola. Thus, the recovery of alloy is high—usually over 90 per cent for silicon and about 85 per cent for manganese.

Booklet Available

Further information is given in our booklet, "Briquetted Alloys For The Iron Foundry Industry." This booklet contains information about "EM" briquets of silicon, silicomanganese, ferromanganese, and chromium. To obtain a copy, free of charge, write or phone our nearest office: in Birmingham, Chicago, Cleveland, Detroit, Los Angeles, New York, Pittsburgh, or San Francisco. In Canada: Welland, Ontario.

The terms "EM" and "Electromet" are registered trade-marks of Union Carbide and Carbon Corporation.

Table I. "EM" Briquetted Alloys for Cupola Additions

Type of Briquet	Gross Weight	Alloy Content
"EM" Silicon Briquets (two sizes) Round	5 lb.	2 lb. Silicon
	2½ lb.	1 lb. Silicon
"EM" Silicomanganese Briquets Square	3½ lb.	½ lb. Silicon 2 lb. Manganese
"EM" Ferromanganese Briquets Oblong	3 lb.	2 lb. Manganese

Table II. Typical Briquet Mixture for Soft Gray Iron

Base Charge			Alloys in Charge Material			
			Silicon		Manganese	
Per Cent	Lb.	Material Charged	Per Cent	Lb.	Per Cent	Lb.
40.0	400	Pig Iron	2.25	9.00	0.75	3.00
40.0	400	Return Scrap	2.50	10.00	0.65	2.60
20.0	200	Purchased Scrap	2.28	4.56	0.55	1.10
100.0%	1,000 lb.	Total Base Charge		23.56		6.70
Briquets Required		4 Small Silicon Briquets		4.00		—
		½ Silicomanganese Briquet		0.25		1.00
		Total Alloys Charged		27.81 lb. Si or 2.78% Si		7.70 lb. Mn or 0.77% Mn
		Melting Recovery Factor		x .90		x .85
		Final Analysis of Iron		2.50% Si		0.65% Mn

WORLD-WIDE RECOGNITION

among the leading automotive manufacturers, too

Lectromelt Furnaces are now being built for the European automobile manufacturers, Fiat and Renault, and for a number of the industry's leaders in the United States—further evidence of the high esteem in which these furnaces are held by leading industrialists all over the world.

Parts Suppliers, too

Lectromelt Furnaces have long been employed in making automotive parts: Piston rings since 1919, cylinder blocks since 1927, malleable products since 1925, as well as crankshafts and other products.

Lectromelt Furnaces offer you rapid top-charging, high-speed melting, accurate control of quality, low-cost operation. Lectromelt field engineers are available to help you keep abreast of the latest developments in the use of your furnace.

For Bulletin No. 7 giving you further data, write Pittsburgh Lectromelt Furnace Corporation, 314 32nd Street, Pittsburgh 30, Pennsylvania.

Manufactured in... CANADA: Lectromelt Furnaces of Canada, Ltd., Toronto 2... ENGLAND: Birlec, Ltd., Birmingham... SWEDEN: Birlec, Elektkaugnar A/B, Stockholm... AUSTRALIA: Birlec, Ltd., Sydney... FRANCE: Stein et Roubaix, Paris... BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege... SPAIN: General Electrica Espanola, Bilbao... ITALY: Forni Stein, Genoa.

WHEN YOU MELT... MOORE RAPID *Lectromelt*

DO YOU NEED THOROUGHLY CONDITIONED SAND TO MAKE BETTER CASTINGS?

This drag scoops the sand from the floor and eliminates any layer of unconditioned sand

This Moulders' Friend was rolled off a truck on to the floor of a North Carolina foundry where it conditioned all of the moulding sand without any rearrangement of the heaps. The Moulders' Friend will fit your foundry too.

THE MOULDER'S FRIEND GIVES YOU THOROUGHLY CONDITIONED SAND

The thousands of flat tempered steel wires in the brush revolving at high speed pick up small particles of used sand, added bond and moisture and blend them thoroughly. This process is so thorough that either clay bond or new moulding sand is blended with the heap successfully and a minimum of moisture is required.

THE BRUSH DOES THE JOB

●

THE MOULDER'S FRIEND SAVES MONEY . . .

capacity over one ton per minute—one man operation—simple construction—easy to buy and use—pays for itself with better castings and less labor.

Investigate The Moulders' Friend today. See one in operation.

"The Moulders' Friend"
Dallas City, Illinois

"dag" Dispersions Lubricate, Assist Parting at any Foundry Temperature

"Dag" dispersions offer numerous advantages as parting compounds and as lubricants because they work at *any* temperature to be met in the foundry . . . even up to 5000° F. in inert atmospheres.

Use **"dag"** dispersions to coat permanent molds, patterns, flask pins, chills, cores, shoulder screws, push pins . . . even to coat ladle interiors.

Molds and patterns so treated give superior reproduction and smoother casting surfaces. Less finishing is required, often none at all. Rejects are fewer and inspection takes less time. Mold life is lengthened.

Binding and stripping of flask pins is eliminated, an important saving in time and maintenance. Chills and cores are easily removed without damage to castings. Molten metal flows freely and completely from ladles without waste from adhesion to inside surfaces.

Write today for the free Acheson booklet which describes in detail how these and other advantages of **"dag"** dispersions give you increased production, more pieces per hour of labor, and measurable material savings. Ask for Bulletin 425-14B.

dag DISPERSIONS®

Acheson Colloids Corporation Port Huron, Mich.

...also Acheson Colloids Limited, London, England

AIR VIBRATORS

for Foundry Operations

Foundry-engineered for a wide range of applications, SPO air vibrators feature full-power starting, high-speed operation, low air consumption, and a long trouble-free service life.

These dependable, low-cost vibrators have repeatedly proven their ability to withstand continual hard usage and still perform with maximum efficiency. Operating on standard line pressures, powerful SPO vibrators increase the production capacity of molding machines, facilitate removal of matchplate patterns from sand molds, perform shake-out operations, and assure a steady flow of granular materials from hoppers, bins, and chutes.

Seven different types of SPO vibrators are available from stock in a range of sizes to meet every foundry vibration need.

For complete information, write today for BULLETIN 50.

New BULLETIN 50 contains data and specifications on standard line of SPO air vibrators.

SPO

INCORPORATED

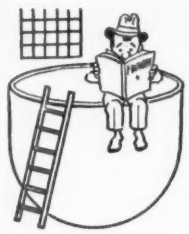
6449 GRAND DIVISION AVE., CLEVELAND 25, OHIO

Reader's COMMENT

Pointers on Caustic Pots

TO THE EDITORS:

I take a keen interest in the "Questions and Answers" section of FOUNDRY, and particularly those shown in the November, 1950, issue. This is in reference to the question regarding the production of caustic pots.



I am foreman of the loam and dry sand department for this foundry. I am submitting this in the hopes that it may be of some value to those experiencing difficulty in making the caustic pots.

We have made large pots in the past and gated them with gates 1 in. thick, 2½ in wide. This allowed us to get colder iron in much faster than we could through small round gates. Then, we made a wooden trough about 12 ft long, placed it on the opposite side of the mold which enabled us to get hot metal in the top of the gate where it will do the most good. We poured with two cranes and two ladles. It is our practice to pour large molds all the way around with the gates evenly spaced. We use two or four indirect risers off the side of the top flange.

The risers are made as thick as the flange will permit and about 5 in. wide and made up as high as the gate. This will permit the gas to get off fast. You can also pour hot metal in the risers and stand a much better chance of having a solid casting.

On pots of this type, we also manufacture a male and female joint that allows us to make the core in one place and the mold in another. We make a covering plate that we first place on the core and bolt to the arbor in the bottom and then place on the mold. By so doing, we use no thickness sand.

GEORGE KEE

United States Pipe & Foundry Co.
Burlington, N. J.

* * *

Error in Silicon Content

TO THE EDITORS:

In the opening paragraphs of the article "Manufacture of Cast Steel Rolls" published in the December FOUNDRY, I stated that a low silicon content is essential in the charge going into the furnace. With a high silicon content in the charge the silicon in the resulting bath will be so high that several hours' labor will be required to eliminate it. The silicon must be reduced before the carbon can be lowered.

In the log sheet of a properly proportioned typical heat shown in Table I, p. 188, the first line listing the charge reads: C 2.70, Si 1.50, Mn 1.15 per cent. This should read: C 2.70, Si 0.50, Mn 1.15 per cent.

The final analysis as shown in the log sheet is correct. The silicon content is from the 200 lb 15 per cent ferrosilicon added at 11:03 a.m.

S. R. ROBINSON

3974 *Jackdaw St.*
San Diego, Calif.

* * *

Are Foundries Progressing?

TO THE EDITORS:

I'm just the average man in the street—just small fry. My duties, however, entail directing the destinies of an insignificant industrial manufacturing concern. As such, the design, availability and quality of the castings used in the manufacture of our machines are, indirectly, my responsibility.

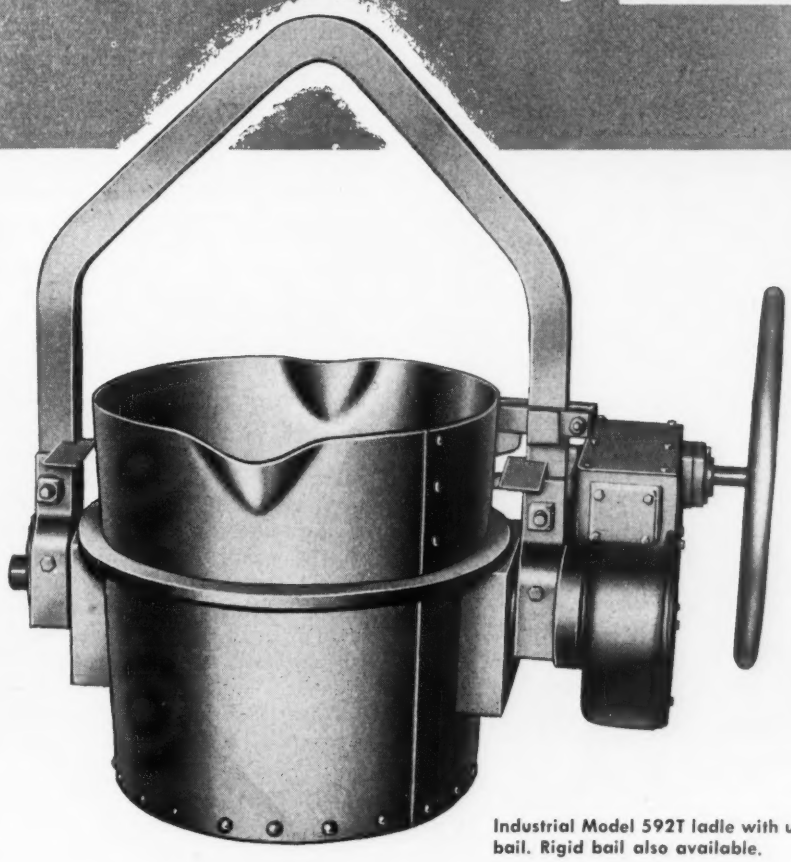
Our company is almost 100 years old. It started as a "one-man shop" and has remained a small, cohesive unit devoted to the manufacture of one product for one general specific purpose. There is, more or less, a saturation point in the number of our units which industry can absorb annually, but rather than expand our facilities by manufacturing sidelines, we have elected to remain small—to concentrate on one type of apparatus, and try and make that one the *best*.

The writer, in his foundry contacts, has observed many changes in casting practice the last 25 years. A lot of these changes, while labeled "Progress," seem to be stretching the point to be so classified.

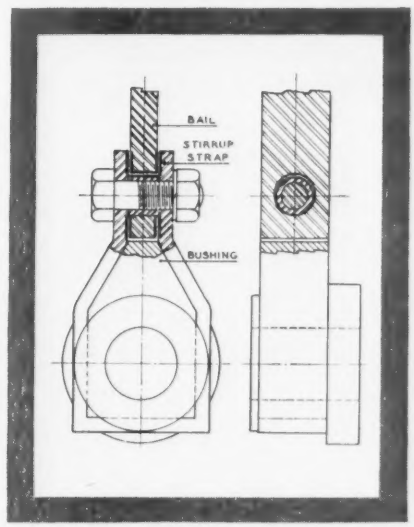
That the finger of fault can be pointed at one single spot is extremely doubtful, but the fact remains that, compared to the quality of average machinery castings of a quarter-century ago, present day average machinery castings are, to put it mildly, junk!

(*Continued on page* 84)

AT LAST... Binding due to heat distortion COMPLETELY ELIMINATED in this revolutionary Universal Bail Design



Industrial Model 592T ladle with universal bail. Rigid bail also available.



More flexibility than a universal joint. Ample vertical and horizontal adjustments. Misalignment taken care of by rotating swivel action.

Here is one of the really fundamental advances in geared ladle design. Binding problems caused by the steady rise in pouring temperatures have been solved . . . with no sacrifice in strength, safety, or simplicity.

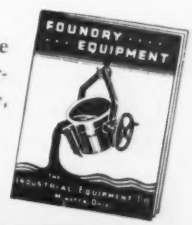
You get four distinct advantages with this new universal bail by Industrial Equipment:

1. **Binding due to heat distortion is eliminated.**
2. **Binding due to misalignment is eliminated.**
3. **Gear wear due to binding is eliminated.**
4. **No lubrication or adjustment is ever needed.**

This new bail is the result of a project on which Industrial Equipment has been working for over four years. Many novel and ingenious designs were proposed and discarded before the final design was accepted. Like all good things it is simple. Yet notice that in addition to simplicity it is rugged, safe, and dependable.

You should also know that this new bail has been thoroughly foundry tested. We emphasize this because the more severe the conditions, the more evident was its design superiority. Operators, for example, say they have never operated a ladle that was easier to handle *regardless of conditions.*

Look to Industrial Equipment for the really basic improvements in foundry pouring and handling equipment. *Write, wire, or telephone today for full details.*



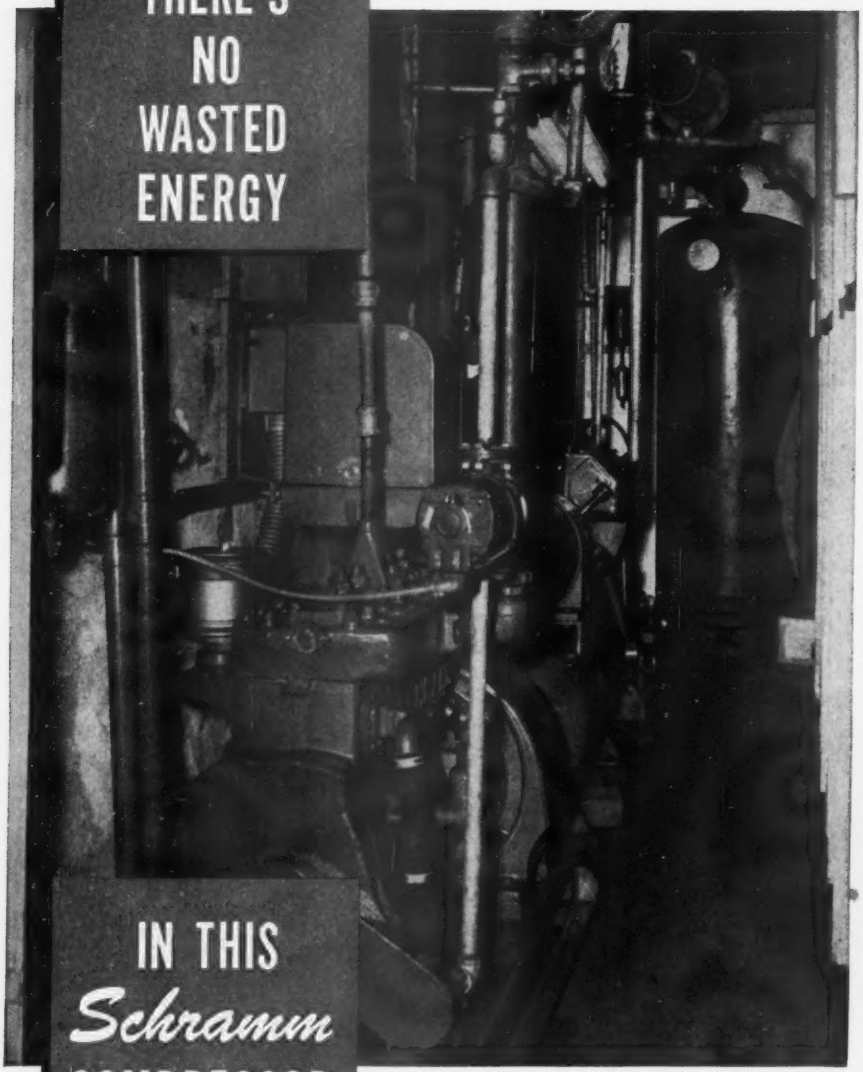
Do you have our revised catalog No. 35?

Industrial EQUIPMENT CO.

115 N. OHIO ST., MINSTER, OHIO

LADLES • BOWLS • SHANKS • BAILS • TONGS • SPECIAL EQUIPMENT

THERE'S NO WASTED ENERGY



IN THIS *Schramm* COMPRESSOR INSTALLATION! . . . providing worthwhile *profits!*

Three of ten SCHRAMM Air Compressors installed in the various shops of Boyertown Auto Body Works, Boyertown, Pa., not only provides air for operating pneumatic tools and appliances, but goes even futher—and delivers BTU's into a system suitable for space or process heating; providing warmth and comfort in winter and air conditioning in summer! By taking full advantage of the uses to which Schramm Air Compressors may be put, naturally, profits result.

For the interesting facts on the conveying of energy, write today for Bulletin P-10.

SCHRAMM INC.
The Compressor People
WEST CHESTER • PENNSYLVANIA

(*Continued from page* 82)

Years ago, even when not specifically requested, pressure-tight castings were taken for granted. A hydrostatic test of pressure vessels was a perfunctory operation; it was assumed that they would be of solid structure. Today it is not unusual to find—and every casting *has* to be tested now to be on the safe side—30 to 50 per cent or more porous castings in a shipment, all of which have to be "doctored" up to be usable. Indeed, quite a lucrative business has been developed by aggressive firms in sealing such defective castings. Such concerns would have starved to death from lack of business twenty-five or more years ago. Progress?

Occasionally we have old units with satisfactory service of twenty or thirty years or more, returned to us for overhauling (for us, fortunately, there is no problem of obsolescence). In many instances we have taken cast parts from these units which are worn so that they must be replaced, and have fractured the parts. The fractures were a pleasure to look at——a close, even grain in the metal; no hard spots, no defects and as far superior in quality to today's castings as an auto truck is to an ox-cart. Oh yes, you say, but in those days virgin pig or charcoal iron or nonferrous virgin metal was used in the castings. So what? Is the "iron" that is sold today for technical castings—stuff that an old-time foundryman would be ashamed to put into furnace grates—"progress"?

Now let's go out on the foundry floor and see how things have progressed. The old-time molder and his buddy, the coremaker, were "guild" technicians. They knew their jobs thoroughly, and they had a pride of accomplishment in their ability, a factor lamentably missing in industry of many types today. If a pattern was slightly damaged, they had the forethought and the knowledge of how to make a perfect casting therefrom nevertheless—and *did* it! Such a job was a challenge, and they were ever ready and willing to meet it. This was the spirit that conceived these United States of ours; that broke through the wilderness and harnessed rivers; that invented the steamboat, the principle of interchangeable parts, the telephone and myriads of other less spectacular but no less essential items which built this country up from nothing to world

(*Continued on page* 86)

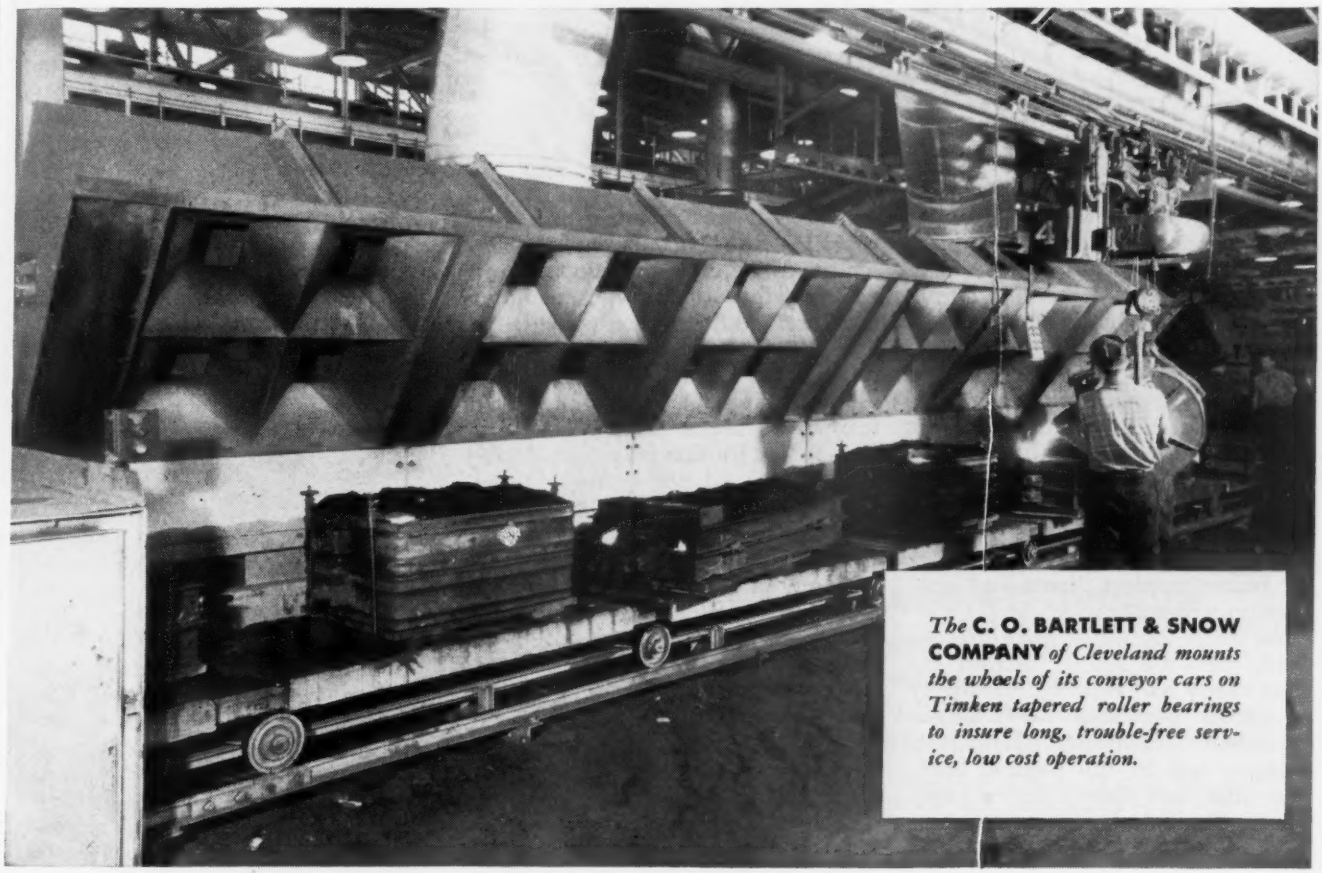
How TIMKEN® bearings help 38 cars keep molds on the move at New Idea

THIRTY-EIGHT Bartlett-Snow mold conveyor cars keep casting production rolling along at the New Idea Farm Equipment Company foundry shown in the photo below. With each 6 ft. 2,000 pound car mounted on Timken® tapered roller bearings, molds and flasks move through the foundry without costly delays for car maintenance. Timken bearings virtually eliminate wear, minimize time-outs for lubrication.

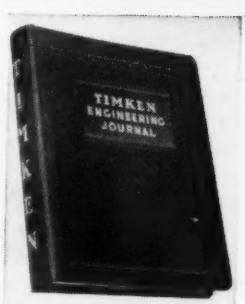
The advanced design of Timken bearings permits the use of tighter closures that keep foundry dust, sand and moisture out—keep lubricant in. Line contact between rollers and races gives Timken bearings extra load-carrying capacity. Tapered construction enables them to take any combination of radial and thrust loads. Made of the finest steel ever developed for tapered roller bearings—Timken fine alloy steel—they normally last the life of the conveyor car. And Timken bearings have extra resistance to wear and to heavy shock loads because of case-hardened, carburized surfaces and tough inner cores.

No other bearing can give you *all* the advantages you get with Timken bearings. Be sure they're included in the equipment you buy or build. Always look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



The **C. O. BARTLETT & SNOW COMPANY** *of Cleveland mounts the wheels of its conveyor cars on Timken tapered roller bearings to insure long, trouble-free service, low cost operation.*

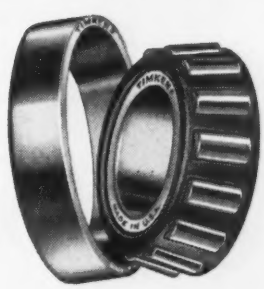


NEW ENGINEERING JOURNAL OFFERED!

529 PAGES! Includes new, technical information on bearing applications available nowhere else. Especially helpful to design engineers. Gives bearing dimensions, capacities, selection and mounting data. For a copy, write on your company letterhead to The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

TAPERED ROLLER BEARINGS

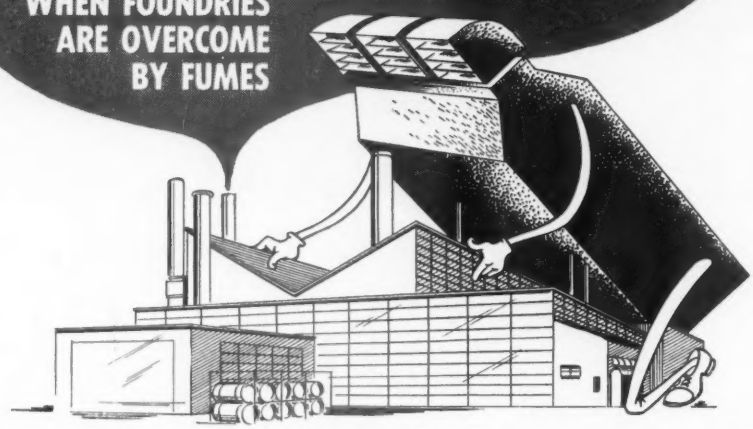


NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ▯ AND THRUST ▯ LOADS OR ANY COMBINATION

DRAVO *Counterflo* HEATERS

Apply Artificial Respiration.....

WHEN FOUNDRIES ARE OVERCOME BY FUMES

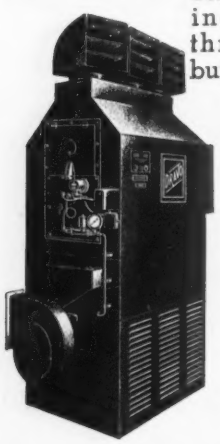


When you start to clear a foundry of smoke, noxious fumes and dust, it's not enough to push the foul air *OUT*. To complete the ventilating job, you must bring fresh air IN!

Natural air infiltration through doors and windows is usually not sufficient to replace exhausted foul air. Mechanical induction of sufficient make-up air takes care of this problem, but generally introduces another. During colder months, this replacement air must be heated, or working areas will be chilled far below comfort levels and production will suffer.

As many foundries have discovered, there's a sound, proven answer ready and waiting: just apply "artificial respiration" with Dravo *Counterflo* Heaters. When cold weather sets in, the heating function goes into instant action, tempering the make-up air to maintain comfortable working conditions throughout the building . . . and, incidentally, overcoming negative pressure and thus increasing the efficiency of all combustion equipment. All through the warm months, the ventilating function provides a continuous supply of unwarmed fresh air to replace foul air.

There are many reasons why foundries make Dravo Heaters first-choice for this responsible job. The range of capacities—from 400,000 to 2,000,000 Btu per hour—provides the proper unit for every load and provides air handling capacity of 11,000 cfm per million Btu output. The heaters can be mounted in any position, and so accommodate themselves to space restrictions. Ready interchange between oil and gas is also a feature. The 80-85% efficiency spells operating economy, and the top-flight engineering, rugged mill-type construction incorporating a stainless steel combustion chamber, minimizes maintenance. Dependable automatic controls make a full-time attendant unnecessary.



Perhaps YOU have a foundry ventilating problem that is affecting worker morale and efficiency—or perhaps you are spending MORE than necessary for heating by old-fashioned methods. For a quick picture of what Dravo Heaters are doing in solving such problems, ask for Bulletin JK-520-132

DRAVO CORPORATION

DRAVO BLDG., PITTSBURGH 22, PA.

Manufactured and sold in Canada by Marine Industries, Ltd. Sorel, Quebec

Export Associates:
Lynch, Wilde & Co. Washington 9, D. C.

(*Continued from page* 84)

leadership in a century and a half.

Today machines do most of the work. In many, many instances this *is* a vast improvement over the past. But, although this is a machine age, we cannot get machines to think for us (though some are trying to get them to). We will never be able to design a machine that will be *proud* that it can perform a certain function; we can never assemble any mechanical unit that will take the place of man's "thought of accomplishment," but we *can*, by mechanical means, so stifle that will, that it is resentfully dormant—or dead. And it would seem to me that, perhaps, that's just what we've been doing—in the name of *progress!*

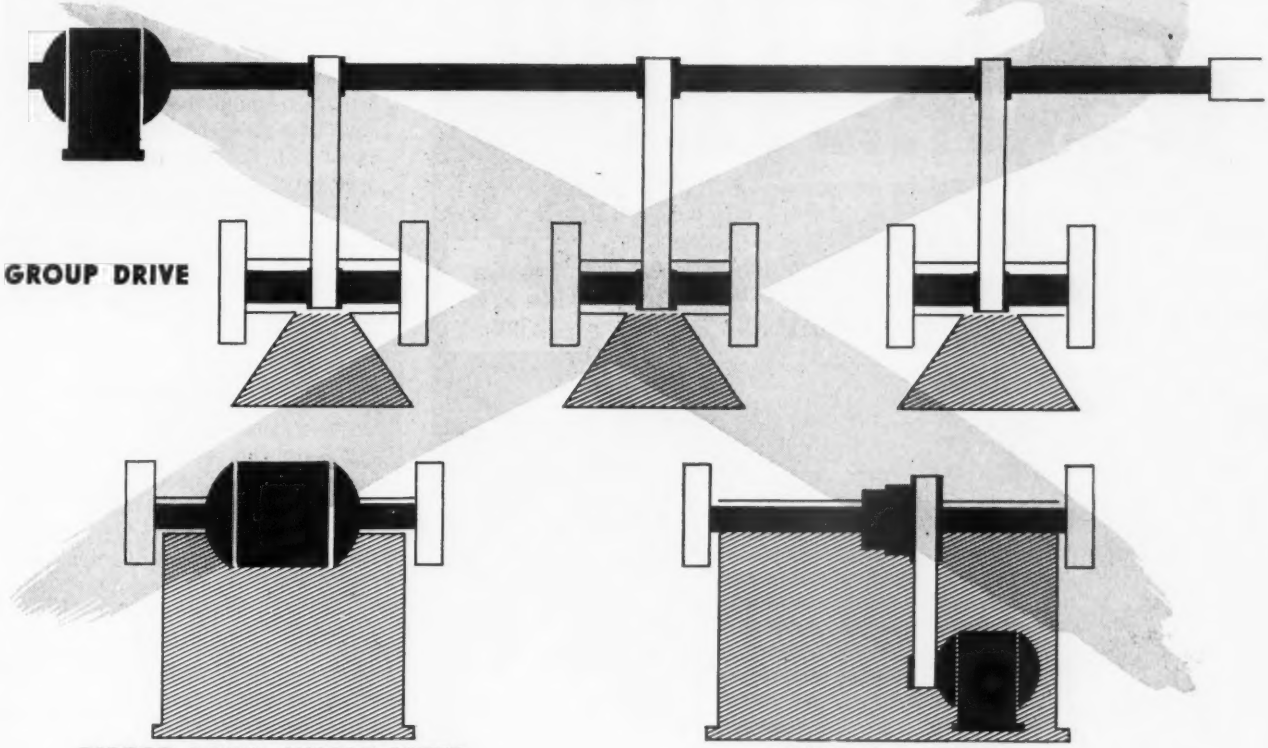
Match plates, patterns on boards outside cores—sure it's easier; sure, you don't need to possess the savvy of the old-time molder—but are the castings any better? Are they as good? Years ago, on special bushing jobs, a sweep pattern of slats could be knocked together—and the foundry would deliver a perfect bushing casting. Today, if a sweep pattern was delivered to a foundry it would probably end up on the rubbish pile—and no casting. In time past if the patternmaker cut the core print a little on the short side, the molder intuitively would know enough to support the cores by adequate chaplets. Today, if the core print won't support the whole core plus the rush of molten metal when pouring—well it's just too bad! Got no time to figure out how to get a good casting from the sand. If it looks too difficult, toss the pattern aside and pick up another one—an easy one—to put in the machine. That's progress!

And what is the solution? Your guess is as good (or better) than mine. I do think, however, that one imperative necessity is for *all* foundrymen—and that includes the executives, the superintendents, the molders, the coremakers and the laborers and apprentices (where have I heard that word before) to be re-instilled with a *pride* in their profession. Because it *is* a profession—a noble profession, whether your hands are blackened by office ink or foundry graphite. That "will to accomplish" *must* permeate the whole undertaking and the industry. Call it a job if you wish—but it *is* a profession. Just because in carrying out it's various ramifications a white collar is quite out of place, does not lessen the dignity of the calling.

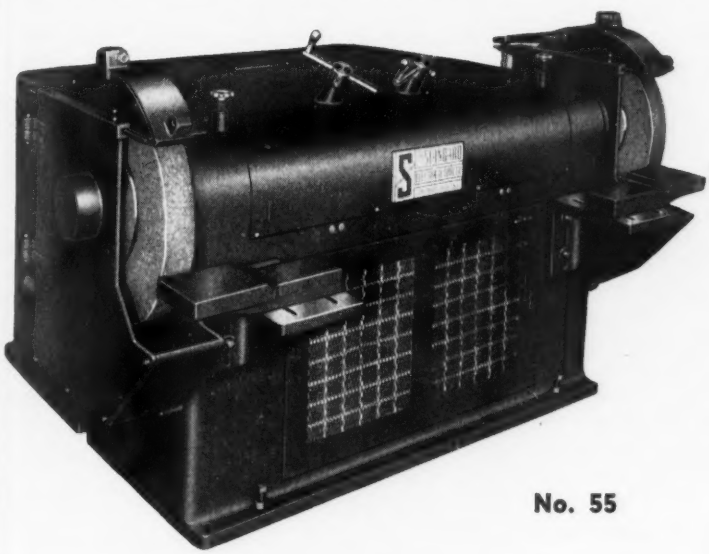
It is not what you wear in the performance of your profession that determines an individual's worth to his community or to his country—it's

(*Concluded on page* 88)

WHY PAY FOR INEFFICIENCY?



HERE'S THE WORLD'S MOST MODERN SNAGGING GRINDER



No. 55

STANDARD'S INFINITELY VARIABLE SPEED TWIN-MOTOR SNAGGING GRINDER

INCREASES PRODUCTION 40%!
INCREASES WHEEL LIFE!
LOWERS WHEEL COST!
EACH OPERATOR INDEPENDENT OF THE OTHER!

24" or 30" Vitrified or Resinoid Bond Wheels.
Twin motors of H.P. selected up to 50 H.P.

The Standard No. 55 is a 2-in-1 machine—each operator is entirely independent of the other; one side may be stationary while the other wheel is operating; one side may be operated with a wheel differing in diameter to the other side, but each wheel operated at its correct and efficient peripheral speed.

SPEED CONTROL: Turn Hand Wheel to adjust **individual** wheel guard as wheel wears and simultaneously increase spindle speed in direct relation to worn wheel diameter, thus maintaining peripheral speed throughout wheel life. Safety interlock prevents overspeeding on grinding wheel.

NOTE: No Tool or Wrenches are required—merely turn the Hand Wheel.

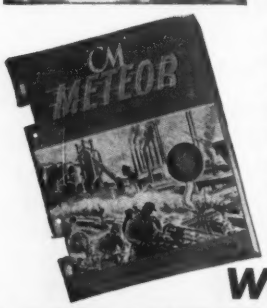
WRITE FOR CATALOG 44 TODAY!

The STANDARD ELECTRICAL TOOL *Co.*

2507 RIVER RD., CINCINNATI 4, OHIO

Foundry work moves faster with

To meet demands for greater production and higher efficiency, many progressive foundries are replacing obsolete, undependable handling equipment with new heavy duty, two-speed Meteors. Designed specifically for foundry work, the Meteor provides slow speed for careful starting of loads... and high speed for fast lifting when the load is free. The Meteor is fully enclosed, weather-proofed and protected against dust and dirt. Airplane-type cooling fins quickly dissipate heat generated by gears and load brake. Low headroom, precision construction, motor thermal protection, only 110 volts in push button station, helical gears, are other quality features. If you want extra value for your investment, write today for literature and prices.



WRITE *for Bulletin 142... contains 22 pages of specifications, illustrations and prices.*

CHISHOLM-MOORE
HOIST CORPORATION
(Affiliated with Columbus-McKinnon Chain Corporation)

GENERAL OFFICES AND FACTORIES: TONAWANDA, N. Y.
SALES OFFICES: New York • Chicago • Cleveland • San Francisco • Los Angeles

(Concluded from page 86)

what he *does*, and the spirit in which he does it. By all means let us have progress, but let it be a progress generated and accelerated by the pride of accomplishment and the willingness to accept challenges—and *win*. The same that enabled our forefathers to build this great country of ours—not the easiest way; in many cases not the fastest way, but the *best* way!

CLARK C. THOMPSON
President

Foster Pump Works Inc.
50 Washington St.,
Brooklyn 1, N. Y.

* * *

Pat-on-Back Department

TO THE EDITORS:

One of the widely accepted fundamentals of steel casting design is that it seldom can be said of any structure that it is perfectly designed—that no further improvement is possible. You have just staged a very convincing demonstration that the truism also applies to technical publication. Reference: FOUNDRY—Jan. 1951.

From my vantage point, *The* FOUNDRY, bless it, made an enduring impression as a consistently commendable and useful technical publication—thoughtfully edited, informative, provocative, frequently entertaining, and always intelligently attuned to the interests of its selected audience. Now, minus the *The*, decked out in a distinctive new dress, reshuffled and reinforced with new departmental treatments, FOUNDRY is even more of a credit to all who have a hand in its production.

It's a fine job—and admired by this sideliner—even though the old, familiar version never seemed to me to require any excuses or apologia on your part. Especially appreciated: The News Report—which *is* a timely and valuable *news report* and not just a collection of odds and ends purporting to substantiate the logotype.

JACK OSBORN FELT
Public Relations Counsel
18 E. 41st St.
New York 17, N. Y.

●

TO THE EDITORS:

Just got my first look at the new cover which made its appearance on the January, 1951 issue. It certainly is attractive, and quite in keeping with the general character of your magazine.

You folks should be very proud of the appearance of this issue.

H. E. HELLING JR.
Advertising Manager
Mathews Conveyer Co.
Ellwood City, Pa.

Oxygen cuts electric furnace melting costs over $2,000 per month

WEHR STEEL COMPANY, of Milwaukee, Wisconsin, wanted to compare the refining of acid electric steel using oxygen with that of their usual method — the use of iron ore. They hoped to reduce refining costs without affecting the quality of the finished steel.

Clarence Nolan and W. R. Lysobey, Airco Technical Sales Representatives, were called in and suggested a series of test heats using Airco oxygen. On the basis of these tests, it was found that the cost of Airco 99.5% pure oxygen is about the same as the iron ore it replaced . . . *but,* the savings in ferro manganese, heat time, electrodes and power were appreciable — amounting to more than $1.00 per ton melted on a monthly tonnage of about 2,000 tons. Furthermore, the high quality of the steel was maintained.

Additional savings were also enjoyed when the problem of handling and storing iron ore was eliminated.

The Wehr Steel Company was most pleased with these results and have adopted oxygen refining of acid electric steel as standard practice.

For technical assistance on this unique refining process or a copy of our folder "Oxygen In The Electric Furnace," please write to your nearest Airco office.

AIR REDUCTION

AIR REDUCTION SALES COMPANY • AIR REDUCTION MAGNOLIA COMPANY
AIR REDUCTION PACIFIC COMPANY
REPRESENTED INTERNATIONALLY BY AIRCO COMPANY INTERNATIONAL
Divisions of Air Reduction Company, Incorporated
Offices in Principal Cities

More news about AIRCO steel mill processes

ACETYLENE SMOKING ELIMINATES HYDROGEN TRACES ON STEEL SURFACE

A leading steel mill, after experimenting on more than 2,000 molds of various sizes, plans to use acetylene ingot mold smoking in all molds that will be used for the pouring of "Tool Steels", "Electric Furnace Steel", "Acid Open Hearth Steel", and "Roll Foundry Steel". They claim that steel poured in molds — *and treated in any other way than by acetylene smoking,* show traces of hydrogen in the surface of the steel.

THE ECONOMICAL WAY TO CUT HEAVY SCRAP TO CHARGING BOX SIZE

Today, Airco offers steel men outstanding oxyacetylene cutting methods for easy and economical handling of heavy scrap. Practically any heavy scrapping job can be handled . . . regardless of size, shape or location . . . with:

- **the oxyacetylene torch, plus oxygen lance.** Buttons, ingots, and similar large chunks can be cut to size in any position without initial handling.
- **machine gas cutting.** Where crane facilities are available, this set-up is ideal. All it requires is a heavy-duty cutting torch mounted on a standard Airco No. 40 Radiagraph or a Travograph.
- **the oxygen lance.** Where extremely large sections, such as open hearth spills and huge ingots are to be cut, the oxygen lance should be used.

All this is just another example of how modern Airco oxyacetylene equipment is helping steel mills slash time and costs.

★ ★ ★

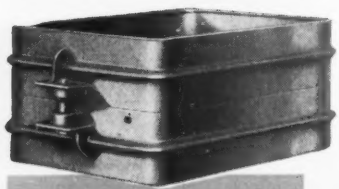
Air Reduction supplies Oxygen, Acetylene and other industrial gases . . . Calcium Carbide . . . and a complete line of gas cutting machines, gas welding apparatus and supplies, plus arc welders, electrodes and accessories. Ask us about anything pertaining to gas welding and cutting, and arc welding . . . we'll be glad to help you.

Sterlings are Built to RIGID SPECIFICATIONS

There's a STERLING STEEL FLASK for every type of molding. Whether you need small or large foundry flasks, there are Sterling Steel Flasks to meet your specific job requirements. Every Sterling is constructed to give you a maximum of strength with minimum weight. Even under rough usage, you are assured of obtaining both accuracy and speed in molding. This is possible only because Sterling Steel Flasks are built to rigid specifications according to modern engineering design. They are backed by almost a half century experience fabricating quality foundry flasks. Write for new Sterling Catalog No. 60.

STERLING WHEELBARROW CO., Milwaukee 14, Wis., U. S. A.

TINY BUT TOUGH!



Sterling Style "E" Flask is designed for tough, small and medium sized work. It is especially popular in brass and iron foundries. Available with interchangeable copes and drags having depth of 2½" and up. Built with combination pin lugs and handles.

Style ⅜ ND-RT Special (72" x 72" x 15"C x 15"D) is a Sterling Heavy Duty Flask with special reinforcing strips on both cope and drag. Its easy, light handling for a flask this size, makes it particularly practical for use in high-production grey iron foundries.

Consult Sterling when in need of foundry equipment. Send for your copy of Sterling Catalog No. 60, just off the press.

LARGE BUT LIGHT!

MORE THAN 4000 FOUNDRIES USE STERLING FOUNDRY EQUIPMENT

Why Threaten Businessmen?

AT a time when our military forces are being pushed around in Korea and when our nation is faced with ever growing draft calls, $71-billion budgets and constant demands for greater sacrifices on the home front, the ordinary citizen might assume that the regular government departments would abandon business as usual in an effort to help prepare the nation for possible all-out war. But things just don't seem to happen that way.

Take, for example, industry advisory committees which are being appointed by various war agencies. Importance of such committees is emphasized in a recent announcement of the National Production Authority which states they "are the recognized, official instruments for maintaining contact between the NPA and industry on all matters relating to the defense program." Members are selected carefully, and are balanced delicately as to plant size, location, industry segment, and trade association affiliation. Properly selected, these committee members represent the knowledge, experience and know-how so important in permitting industry to render maximum service to the nation's war effort.

Nevertheless, the Attorney General views these committees with some suspicion. He reports to the President that "In anticipation of the antitrust problems surrounding business advisory groups, the Department of Justice" has outlined standard of conduct. These include: 1. Statutory authority or administrative determination of necessity; 2. Agenda initiated and formulated by government; 3. Meetings called and chairmanned by full-time government employee; 4. Full minutes kept; 5. Functions purely advisory and determinations of action to be taken made solely by government representatives.

The Department of Justice then states, "So long as these activities of industry advisory committees are carried on within these limitations, we would not view the activities as constituting an independent violation of the antitrust laws. We wish to emphasize, however, and it should be clear to participants in such activities, that the Department of Justice retains complete freedom to institute proceedings, either civil or criminal, or both, in event that any particular plan or course of action is used to accomplish unlawful private ends."

It is a wonder that good men will accept membership on these important industry advisory committees in the face of suspicions and threats by the Department of Justice.

Mr. Attorney General, it is time to realize that government must co-operate with industry and business in promoting war production. The men you intimidate already have proved their patriotism in the record of production during World War II. Many have sons or other near relatives in the armed services. All realize that nobody will profit in the war effort under way. But they stand ready to do a job if you will help.

Let's cut out these threats and insinuations and get going on the war production problem!

Frank G. Steinbach
Editor

Modernized Foundry GAINS IN EFFICIENCY AND CAPACITY

By CARL G. PRESSER
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Fig. 1 — Three concrete silos are employed to house and distribute core sand

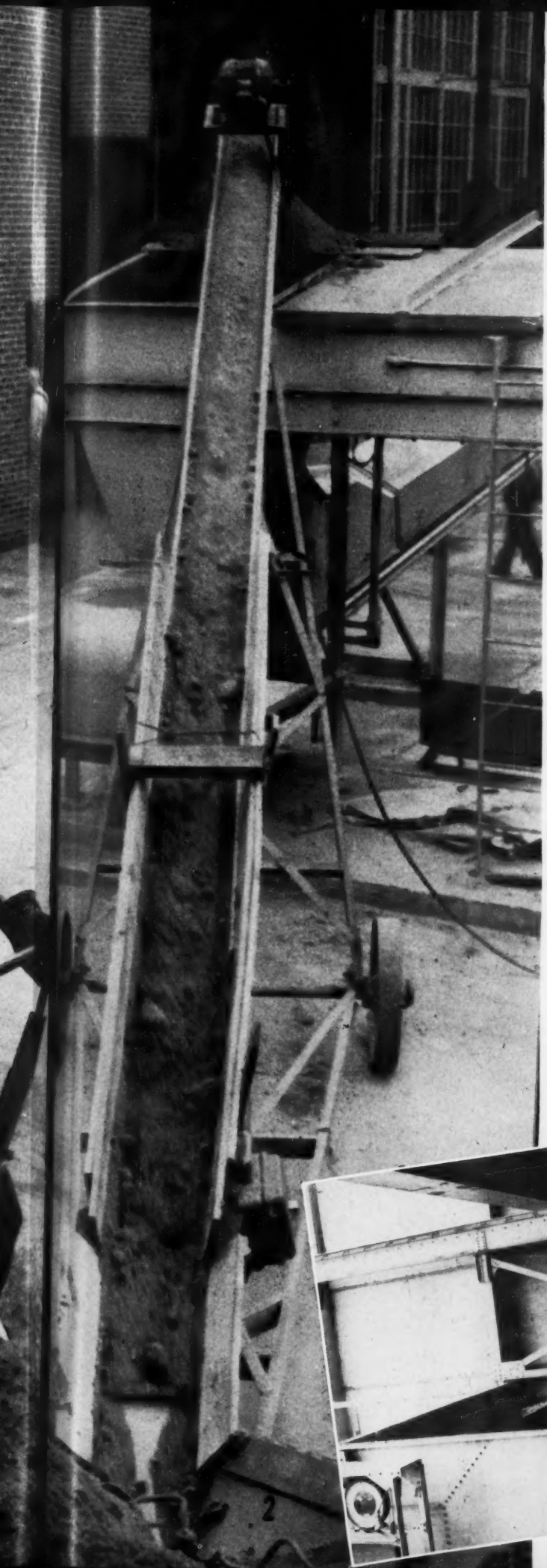
Fig. 2 — New molding sand being removed mechanically from freight car direct to a hopper feeding, via belt conveyor, to storage

A SWEEPING modernization and mechanization program for the gray iron foundry of the National Supply Co.'s Engine Division at Springfield, O., was completed recently at a cost of $1,250,000. The program affected every department and has greatly improved overall efficiency and capacity for both company and jobbing operations. Fig. 11 shows the general arrangement of the plant.

Additions to the melting department include two new cupolas, each having a capacity of 10 to 14 tons of metal per hour, new storage facilities for raw materials, and a new handling layout. The cupolas, of the latest type with tuyere regulation, have a shell diameter of 90 inches and are lined to 60 inches within the melting zone. They are operated on alternate days but may be operated simultaneously, if necessary.

Cupolas are designed for rear slagging. A V-shaped metal trough, supported by cables on a monorail track behind the cupolas, can be swung under the slag spout of either cupola. A constant stream of water granulates the slag and washes it down the trough into a perforated drop bottom bucket. A replaceable wood lining at the slag spout end of the trough assures proper slag flow. Filled buckets are carried out of the water pit by a monorail track to dump trucks into which the cracked slag is emptied for disposal.

A unique feature of the monorail charger is an integral retractable boom, shown in Fig. 5, which supports the cone-bottom buckets, thus eliminating the conventional method of resting the buckets on a cupola boom. The monorail charger picks up its load from a "merry-go-round" roller conveyor, shown in Fig. 6, which includes a roller-top cable car to keep five cone-bottom buckets working in a cycle picking



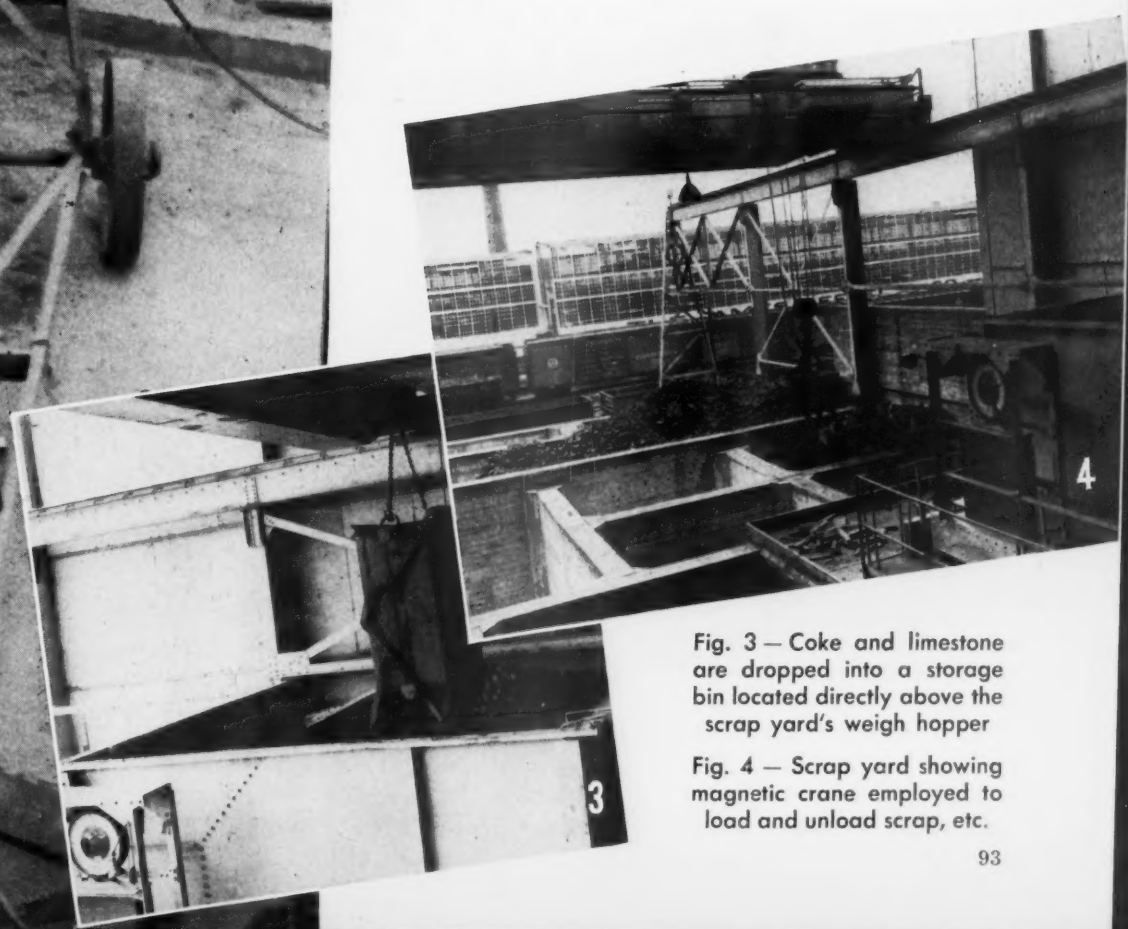


Fig. 3 — Coke and limestone are dropped into a storage bin located directly above the scrap yard's weigh hopper

Fig. 4 — Scrap yard showing magnetic crane employed to load and unload scrap, etc.

Fig. 5 — Cone-bottom bucket loaded with coke, limestone and metal enters cupola by means of crane-operated monorail charger

Fig. 6—"Merry-go-round" roller conveyor. Buckets in foreground are loaded with coke, limestone and metal for transfer to the cupola

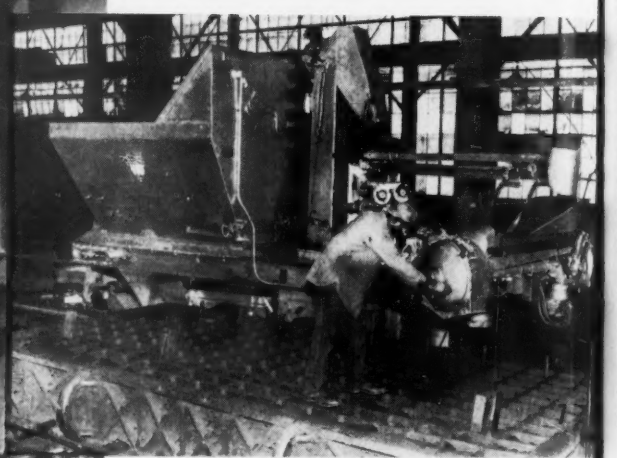


Fig. 7—This sandslinger automatically rams sand in one operation. It travels on a track which extends the full length of the foundry floor

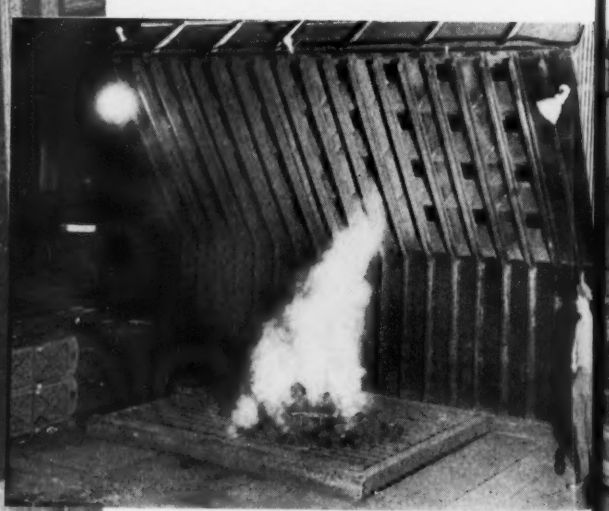


Fig. 8—Contamination of surrounding air by the mold shakeout is prevented by exhaust unit and dust collectors

up the raw materials for making up cupola charge.

Empty buckets initially travel by gravity on the rollers to a metal weigh hopper where the required amount of metal is picked up. The cable car picks up the bucket and transfers it underneath coke and limestone weigh hoppers. The bucket is then tilted hydraulically on the cable car until it rolls onto the roller conveyor on which it travels by gravity to a position for pickup by the charger.

Raw materials are supplied to the hoppers from several outdoor concrete storage bins, shown in Fig. 4, which are adjacent to a railroad siding. These include a skull cracker bin and coke and limestone track hopper.

An 80-foot span, 7½-ton yard crane with 55-inch diameter electromagnet breaks and transfers scrap iron from storage bins to the weigh hoppers. The dial scale of the weighing mechanism is suspended on the charging platform adjacent to the weigh hopper where the crane operator can see it clearly.

Coke and limestone, received in bottom-drop gondola cars, are transferred from a concrete track hopper under the railroad track to storage bins by means of a drop-bottom bucket, as shown in Fig. 3. Air-operated slide gates in the track hopper allow the material to flow by gravity into the bucket. The crane then lifts the buckets over adjacent bins above the weigh hopper, as shown in Fig. 3, and empties them. The unloading system is efficient and also minimizes coke breakage, thus assuring proper size for the cupolas.

Tapping and Pouring—After tapping iron into ladles, it is transferred a maximum of 100 feet for pouring into molds. Metal is poured on either the center or side floors. Only dry sand molds are filled on the center floor. For these molds ladles of 1500 to 13,000 lb capacity are handled by overhead cranes.

Green sand molds on the side floor are served by ladles of 500 to 1500 lb capacity. These ladles are transferred from the cupola by track car and are placed in pouring positions by an overhead crane.

The foundry produces not only castings for its engine division, but also to meet outside jobbing requirements. Diesel engine castings range in weight from ½ to 17,000 lb, and include cover plates, valve guides, pistons, liners, cylinder heads, cylinders, bed plates, blocks, intake and exhaust manifolds, flywheels, counterweights and other parts.

Castings ranging from ¼ to 30,000 lb have been produced for outside customers. Castings as small as ½-oz can be produced. Typical parts include cover plates for a mill base, high-pressure valves, housings, gear boxes, transmission cases, sleeves and columns, kiln cars, grinder boxes, lathe bases and many others. Some of these are shown in Figs. 12 and 15. Cupola production of 50 to 60 tons daily can be increased as required.

All metal produced is high-test cast iron, analyzed and controlled by the laboratory. To assure a close-grain high-test metal, the iron is inoculated at the spout by additions of refining and deoxidizing agents. Any range of physical properties up to 60,000-65,000 psi tensile strength can be produced and alloys are used when specified. Metallurgically, the cast iron is produced with graphite type "A" flake, size 4 to 5, finely dispersed with a pearlitic matrix.

Casting design consulting service is offered to assure use of the best production practice, most economical foundry methods, satisfactory type of iron, and to be sure that all other factors are taken into consideration.

Coremaking—A complete rearrangement and enlargement of the coreroom was included in the modernization program. The building was altered to make room for a traveling crane of 44-foot span to serve large coremaking operations and car type ovens, which are pictured in Fig. 13. Alterations also allowed for the erection of a new vertical tower type core oven, shown in Fig. 14. Either gas or oil can be used as fuel for this oven and several of the car type ovens were converted to use either fuel when relocated.

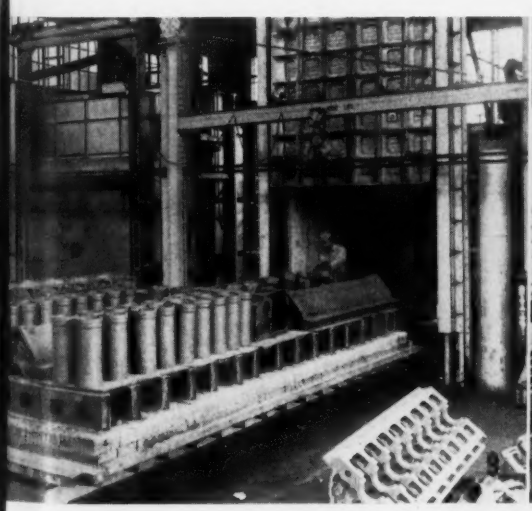
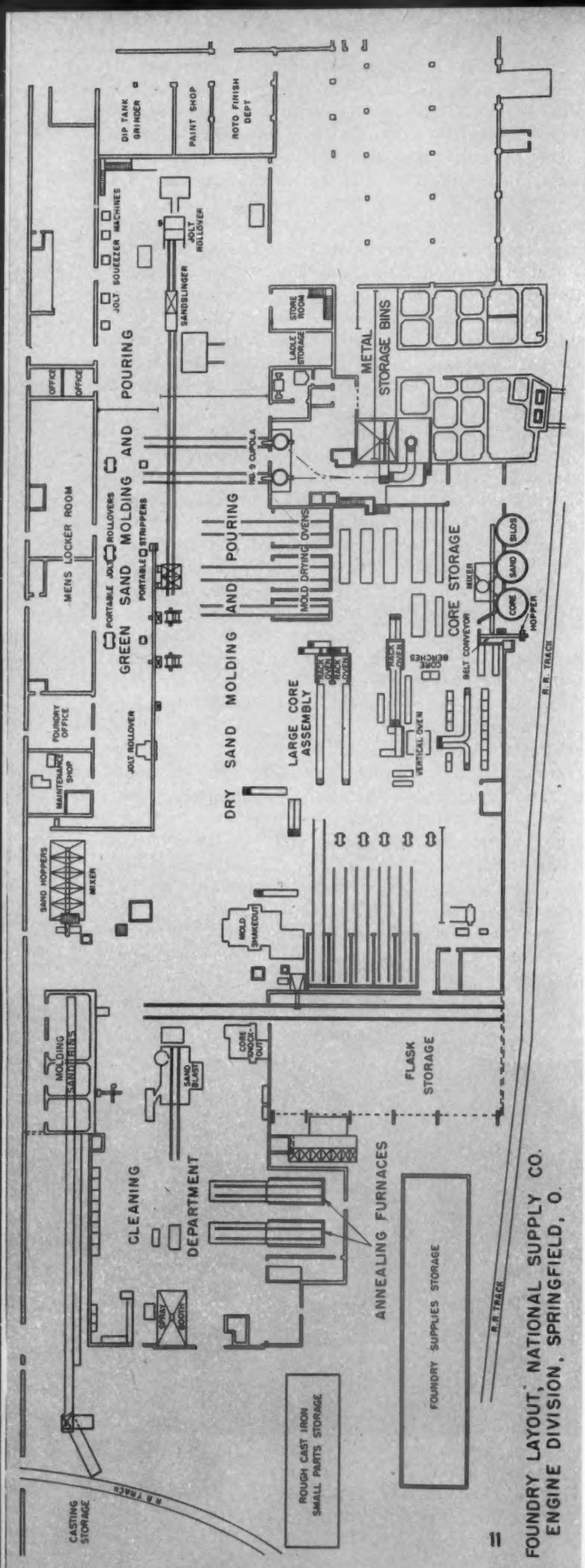


Fig. 9—Furnaces used to stress relieve castings. Unit at left installed recently

Fig. 10 — Storage yard where flasks are neatly stacked is served by traveling crane



Ample space was provided for large and small core assemblies, and a roller conveyor system was provided to move them directly into paste drying ovens. Ovens are emptied into a storage space fully adequate for preserving them until used. Large assembly cores are delivered into the foundry by means of a roller conveyor projecting into the main bay.

Roller conveyors are also provided in a modern layout for bench coremaking. They feed cores into the vertical tower oven from which they are eventually transferred by roller conveyor to the small core assembly system.

Core sand is stored in three weather-proof concrete silos, shown in Fig. 1, which are 14 feet in diameter and 40 feet high. The sand is purchased in the dry state and brought to the plant in closed box cars. It is plowed out into a hopper shown in Fig. 1, adjacent to the track, where a belt conveyor picks it up and elevates it to a position where it can be plowed off into any of the three silos.

The silos, which are a part of an outside wall of the coreroom, are of the recirculating type with an upper storage shelf that feeds sand by gravity into weigh hoppers above the sand muller. When the upper shelf has been filled, sand slides over its sides and falls to the bottom of the silo. With this system, sand may be tapped from either of two spouts—one at the upper shelf and the other near the bottom of the silo. When the supply of sand on the upper shelf is exhausted, the storage below is recirculated and sand flows to a conveyor that elevates it and once more fills the shelves with the required amount.

Dry sands of different types are combined in specified proportions in weigh hoppers and deposited by gravity into the sand muller below. Water and core oil are piped into the (*Please turn to page* 236)

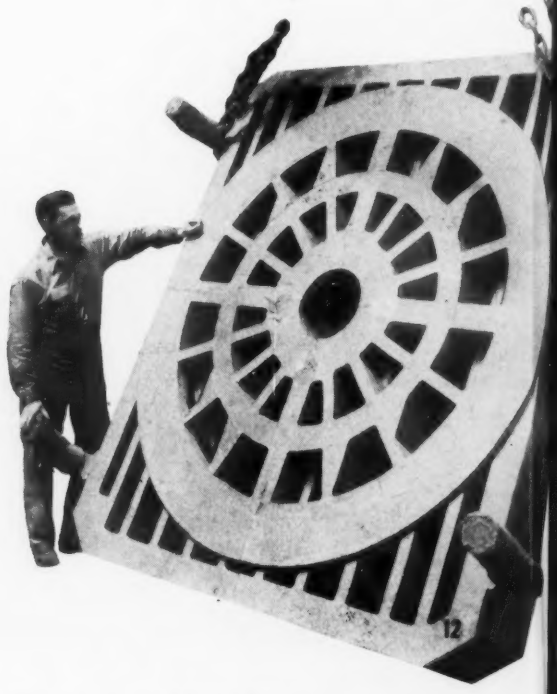


Fig. 12—This large revolving table top casting is used by the machine tool industry. It weighs approximately 26,000 lb

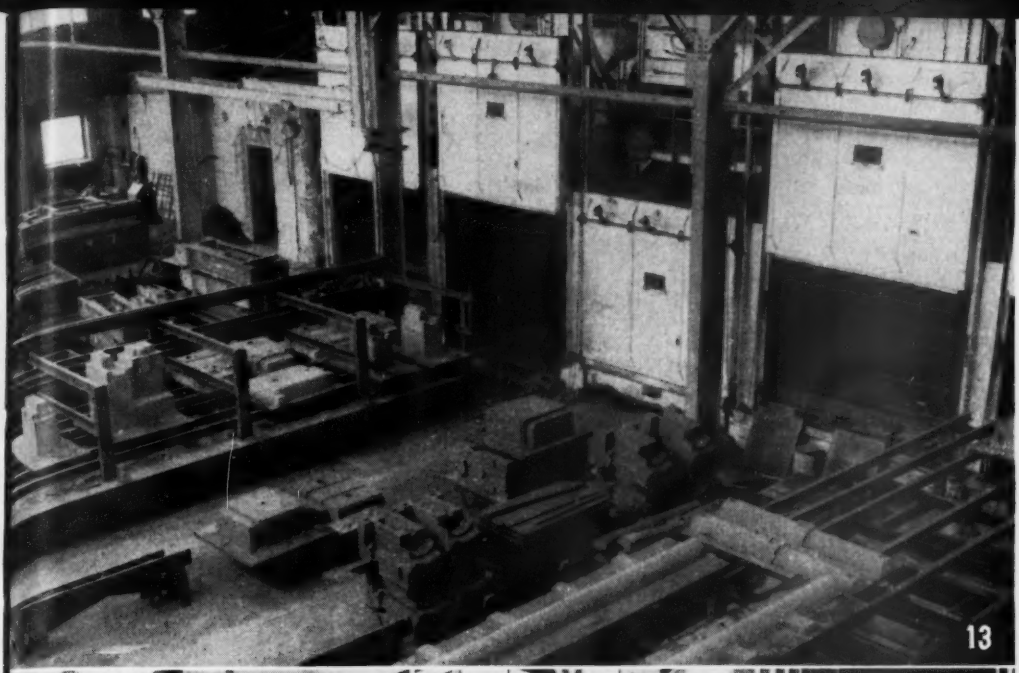


Fig. 13 — General view of the car type core ovens employed in baking larger cores

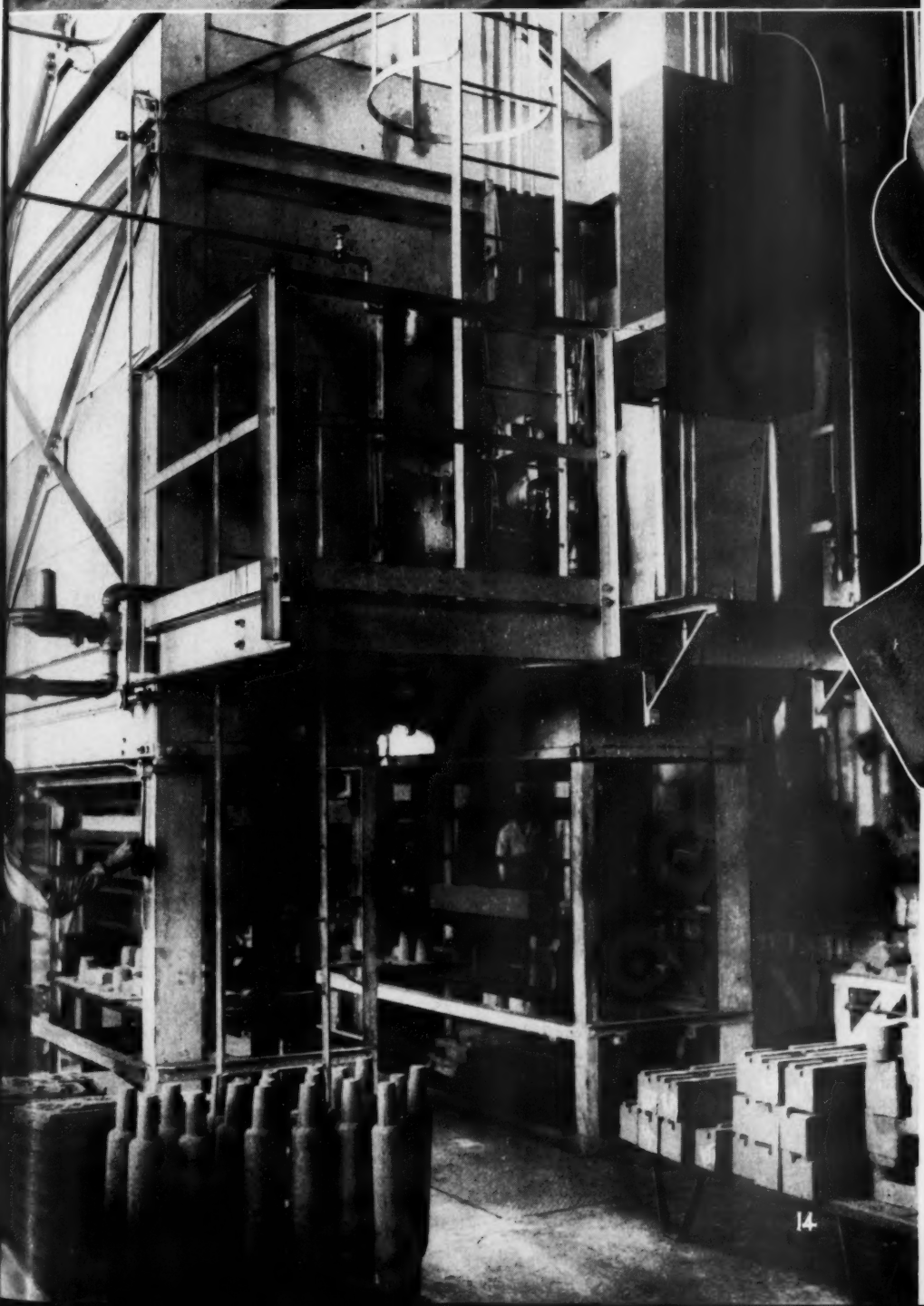


Fig. 14 — This vertical tower type core oven handles the majority of small cores and can burn either oil or gas

Fig. 15 — Typical machine tool castings produced at this foundry

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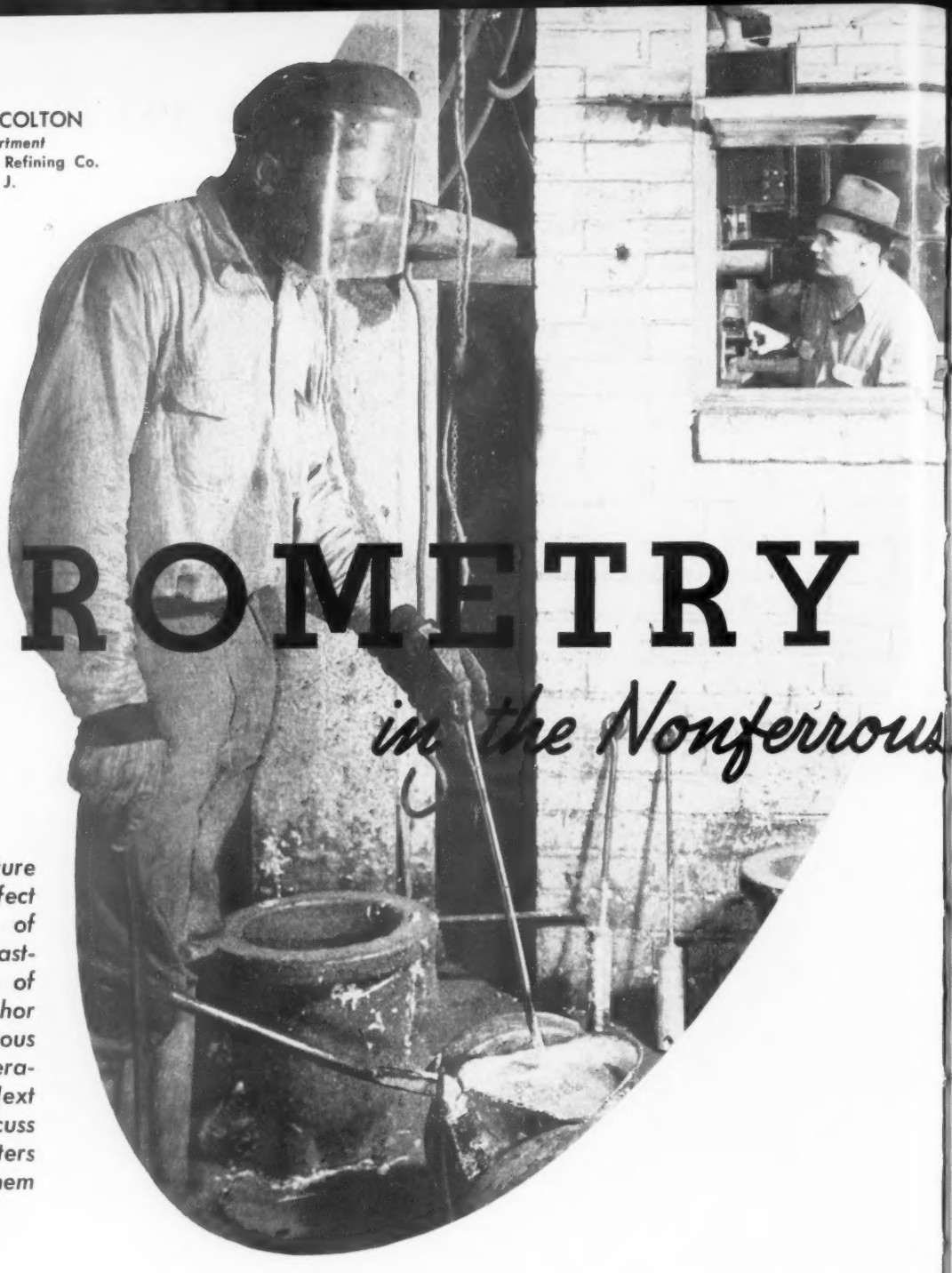

PYROMETRY

in the Nonferrous Fo

Pouring temperature has an important effect on the properties of nonferrous metal castings. In this first of two articles the author describes the various influences of temperature control. Next month he will discuss types of pyrometers and how to use them most effectively

WHY measure the temperature of every pot or ladle of metal poured?" That question undoubtedly has been asked by most of nonferrous foundrymen. It is a fair question because almost every article or talk on foundry practice today emphasizes the need for measuring pouring temperature accurately. Consider the fact that, until comparatively recently, temperature measurements of molten metal in brass and aluminum foundries were most uncommon—and castings were produced in large quantities and used with apparent satisfaction by industry. Why, then, has the need for controlling pouring temperature become so important in recent years?

One obvious answer to the latter question is that the standards of acceptance of industry have become more rigid, and castings produced 25 years ago might be unacceptable by today's standards. For the practical foundryman, however, that answer isn't enough. What are the technical reasons for taking this step —sometimes tedious and expensive—of measuring the temperature of metal before it is poured into the mold? What advantages are to be gained and what trouble is avoided by temperature measurement? To provide reasons to the skeptical and arguments for the advocate, some of the principal effects of temperature on the behavior of molten nonferrous alloys are described here.

Effect on Production—Perhaps the most obvious of all reasons for controlling the pouring temperature is that, to avoid misruns, cold-shuts or leaving molds on the floor unpoured, it is essential that the metal

be hot enough to finish the job. This part of the story is known to all foundrymen. In many shops where the molder still pours his own castings, it is considered somewhat of a disgrace to misrun a casting. That attitude, of course, leads to the greater offense of always pouring castings more than adequately hot in order to run them all but with no consideration of the other difficulties that might occur. Certainly, the effect on production of knowing the pouring temperature is unmistakable. With an intelligent pouring temperature program and good control in the foundry, misruns can be kept to a minimum and all the problems introduced by using an excessive pouring temperature can be avoided.

In production foundries the problem is somewhat more acute than in jobbing foundries. Here the number of castings per molder per day must be high to reduce costs. For that reason, large numbers of castings must be poured from the same ladle which means that pouring temperature control becomes quite difficult. There is a fair solution to this problem and it will be outlined later.

...us Foundry.....

Effect on Tensile Properties—Much work has been done on the effects of pouring temperature on tensile properties of various nonferrous alloys. Rather complete recommendations have been made for the proper pouring temperature range for making test bars of the brass and aluminum alloys. Interestingly enough, it has been definitely established that the lowest pouring temperature is not always the one that gives the highest test bar properties. In work done several years ago at Battelle Memorial Institute for the Non-Ferrous Ingot Metal Institute it was ascertained that the best test bar properties are found at an intermediate pouring temperature. When the pouring temperature is too high or too low, defects occur in the bars and the tensile properties suffer thereby.

As an example of the effect of pouring temperature on tensile properties, Table I reveals the beneficial effects of using lower pouring temperatures. In these experiments the same metal was poured into a group of test bar molds at successively lower temperatures as indicated. It can be seen that tensile properties increase with reduction in pouring temperature. In general, this is true of all materials, and while the lowest pouring temperature is not desired, it is certainly beneficial to use pouring temperatures on the low side rather than on the high side. This is not true of all copper-base alloys, since certain high-zinc alloys do not seem to be too greatly affected by the temperature at which they are poured into a test bar mold. But in general, control of pouring temperature usually means improved test bar properties.

There is considerable evidence that over-heating the metal in the furnace may also have a serious effect on test bar properties. That is, if the metal is given a 200-300° superheat and then allowed to cool to a suitable pouring temperature, there is no asurance that the test bar properties will be as good as if the metal had been given only a 50 or 100° superheat and poured at the proper temperature. This again is not true of all materials but, assuming that good control of melting atmosphere is maintained, there are possibilities that over-heating the metal has permanent effects which cannot be overcome by using the proper pouring temperature. On the other hand, it is far better to pour the metal at the correct pouring temperature no matter how much it has been overheated, if the best possible test bar properties are to be obtained.

In melting and casting aluminum alloys, control of temperature is important in that the grain size of the metal is a function of pouring temperature; that is, the higher the pouring temperature, the larger the grain size and the lower the physical properties. Some data indicate that overheating aluminum severely may also, in certain cases, coarsen the grain regardless of the pouring temperature. The effect of temperature on grain size is not as evident in copper-base alloys, although the effect on physical properties is marked due to either increased gas solution or higher shrinkage experienced at higher pouring temperatures.

In Fig. 2 can be seen the effects of pouring temperature on the grain size of aluminum alloys showing the extreme differences found between high and low pouring temperatures.

Effect on Soundness—1. *Gas:* One of the most important reasons for controlling temperatures with nonferrous alloys is to help control soundness of the metal. Every foundryman is familiar with the evils of gas porosity in castings and has been told frequently the necessity for maintaining good melting practice. The influence of temperature in controlling gas content in metals is all-important and one of the principal reasons for advocating measurement of pouring temperature in castings.

It was established nearly 50 years ago that the amount of gas dissolved by metals is proportional to the temperature—as the temperature of the metal increases, the amount of gas dissolved may also increase. Conversely, as the temperature drops, the metal attempts to give up the gas it has picked up in heating. It is this change in solubility, or this attempt to give up gas when cooling and solidifying, that causes most of the gas porosity experienced in the foundry.

Under any set of conditions the metal will pick up more gas at a higher temperature. Knowing this fact, it is immediately apparent that over-heating the metal is to be avoided, if at all possible. It is not always possible, however, to control melting in the foundry carefully enough to avoid giving an extra 100° or 200° superheat to the metal. There is no convenient, accurate method for measuring the temperature of the metal in the furnace, so that more often than not the metal is overheated and hence will dissolve more gases than desired.

Since it is so difficult to prevent over-heating of

the metal, especially in gas or oil-fired furnaces, it becomes of even greater importance to control the pouring temperature accurately. As an example, if a pot of copper-base alloy must be poured at 2000°F for optimum properties and behavior in the castings and the metal is heated to 2400° in the furnace, it is necessary that the foundryman know when the temperature has dropped to the proper level. Under normal circumstances when no pyrometer is used in the foundry, the metal will be taken from the furnace, skimmed, any additions made that are required, and poured with the hope that in the interval the temperature has dropped the required amount.

Obviously, this is a hit-or-miss proposition, and more times than not the metal temperature will be too high when it is poured and the castings will not be as sound as if the metal had been dropped to the lower temperature. That is, in heating up to 2400°F the metal has dissolved a certain quantity of gas. As the temperature of the metal falls it will tend to give up this gas. Theoretically, the metal should give up as much as it dissolves in the same temperature range. Practically, however, this is not entirely true; metal heated at 2400° and poured at 2000° will have more gas in it than metal heated at 2200° and poured at 2000°. Even so, it is better to overheat and pour at the correct temperature than to overheat and pour at a higher temperature since use of the proper pouring temperature will help eliminate the gas condition.

TABLE I—Effect of Pouring Temperature on Tensile Properties of 88-8-0-4 (Navy "G") Bronze Using ASTM Cast-to-Size Test Bar

Number	Pouring Temperature, °F	Tensile Strength, psi	Elongation % in 2 in.
1A	2160	41,250	30.0
1B	2160	40,250	29.5
1C	2160	42,900	38.0
1D	2160	42,250	35.0
2A	2060	46,600	51.0
2B	2060	48,250	46.5
2C	2060	48,100	57.0
2D	2060	47,250	48.5
3A	1960	47,250	52.0
3B	1960	49,300	61.5
3C	1960	48,000	53.0
3D	1960	48,250	53.0

Note: Test bars broken in order poured.

Fig. 1—Sectioned and polished casting of 85-5-5-5 alloy showing shrinkage porosity produced by pouring at an excessively high temperature. Veining on cored surfaces also result of high temperature

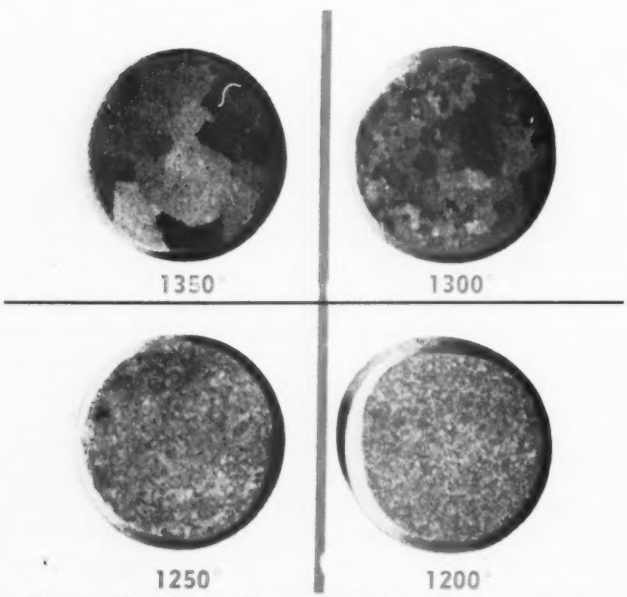

Fig. 2—Illustrating effect of pouring temperature on grain size of 4% Cu, 3% Si aluminum alloy

From the viewpoint of freeing the metal of gases the lowest pouring temperature possible should be used. On this basis alone the use of the minimum temperature that will permit filling of the mold would be advisable. Unfortunately, solving the gas problem by using the lowest possible pouring temperature to fill the mold may introduce other problems, as will be described later. For that reason it is not always possible to pour the metal when it will have the lowest gas content.

Visual evidence of the effect of temperature on gas content of the metal can often be noted in melting and casting the silicon and aluminum bronze alloys. If these alloys are severely overheated under incorrect furnace atmosphere, they will dissolve considerable quantities of gas. If the metal is allowed to stand on the foundry floor in the crucible before pouring and cooled to the proper temperature, this gas will tend to come out of the metal and will burn at the surface. With these two alloys it is possible to see the gas coming out by spurts of flame from the top surface of the metal. In all alloys the gases tend to free themselves as the metal cools in air. For that reason the interval from setting the crucible on the foundry floor and pouring can be a highly beneficial one, since the tendency of the metal to lose gas at lower temperatures will work in favor of the foundryman.

2. *Shrinkage:* Perhaps the most important reason of all for controlling pouring temperature is to avoid shrinkage porosity in castings. This does not necessarily mean the use of a low pouring temperature, since it is necessary to have a high enough temperature so that the risers can feed the casting properly. Many foundrymen mistakenly believe that the lowest pouring temperature is the best pouring temperature; this has not proved to be the case. A good general rule is to use the lowest pouring temperature that will make a sound casting. This may, however, be a higher pouring temperature than the foundryman would normally con- (*Please turn to page* 243)

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EFFECT OF HEATING RATE ON Graphitization of White Iron

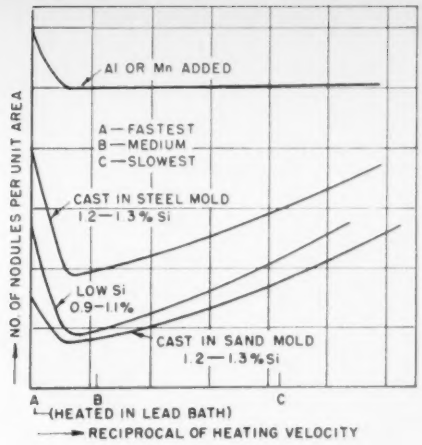


Fig. 1—Number of nodules and heating velocity

SOME time ago the author and T. Tottori[1] reported an investigation on annealing white iron. Results of microscopic examination and dilatometric measurement showed that malleable iron compositions rapidly heated by dipping in a lead bath caused refinement of the graphite nodules in subsequent annealing. Recently Palmer[2] and Schneidewind[3] reported that the slower the heating rate to annealing temperature, the smaller the size of the graphite nodules.

While their results seem to differ from those of Okamoto and Tottori, there is no conflict between them. According to our experiments the effects of all heating rates were not examined in those reports as well as in our previous report. Considering the various heating rates from that of rapid heating by dipping in a molten lead bath to that of slow heating, as in malleable annealing, it can be concluded that the size of the graphite nodules by annealing becomes larger as the heating rate increases and then smaller by extremely rapid heating.

Fig. 1 shows explanatorily the effect of heating rates on graphite nodules, and Figs. 2 to 7 show the changes of size and distribution due to heating rate in annealing. The above tendency is qualitatively unvaried in spite of changes in casting condition and chemical composition of white iron. The experimental data may be explained possibly by the stability of cementite, its growth and the heat treatment.

We have confirmed that the micro-hardness of cementite in white iron is not constant. This leads us to believe that the chemical composition of cementite in complex alloys as in cast iron is slightly, at least, varied from the simple formula Fe_3C, and accordingly the stability of cementite is varied due to the change of its composition.

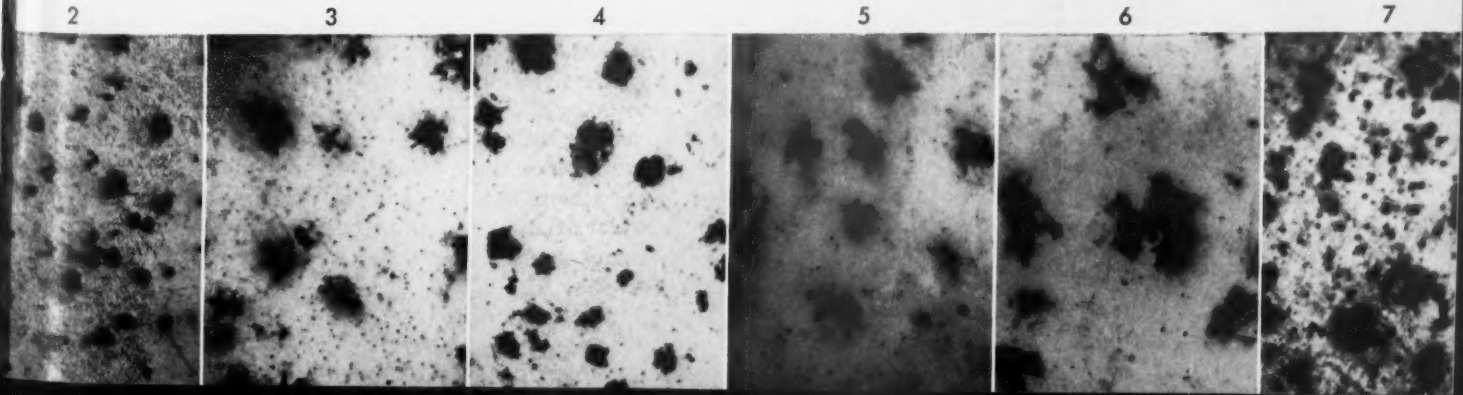
Under the same heating condition the lower the stability of cementite is, the earlier the graphite will be formed, and if the stability of the cementite is comparatively high, its growth may occur before graphitization starts—resulting in larger and fewer graphite nodules in completely graphitized iron. It is clear that the large number of graphite nodules may be caused by the graphitization of small cementite particles without its growth.

Extremely rapid heating by dipping in molten lead results in the graphitization of cementite at the bath temperature before its growth begins. Medium rate of heating such as to 950°C (1742°F) in 12 hr leads to growth of cementite before graphitization begins. Very slow rate of heating such as to 950°C (1742°F) in 45 hr tends to permit decomposition of cementite before its growth begins.

References

1. Masazo Okamoto and Tomojiro Tottori, *Nippon Kinozoku Gakkai-Si*, 12 (1948) 25.
2. S. W. Palmer, *Foundry Trade Journal*, 87 (1949) 107.139.187.
3. Richard Schneidewind, FOUNDRY, 77 (1949) No. 6, 128.

Fig. 2—Specimen No. 1 (2.47 per cent C, 1.29 per cent Si) chill cast dipped in lead bath at 950°C, held for 15 hr, and air cooled. Fig. 3—Specimen No. 1 heated to 950°C in 12 hr, held 15 hr and air cooled. Fig. 4—Specimen No. 1 heated to 950°C in 45 hr, held 15 hr and air cooled. Fig. 5—Specimen No. 8 (2.47 per cent C, 1.29 per cent Si, sand mold, 20 mm diam) dipped in lead bath at 950°C, held 22 hr and air cooled. Fig. 6—Specimen No. 8 heated to 950°C in 5 hr, held 22 hr and air cooled. Fig. 7—Specimen No. 8 heated to 950°C in 45 hr, held 22 hr and air cooled. All specimens unetched, X60



NICKEL-TIN Bronzes

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International Nickel Co.
Metallurgist

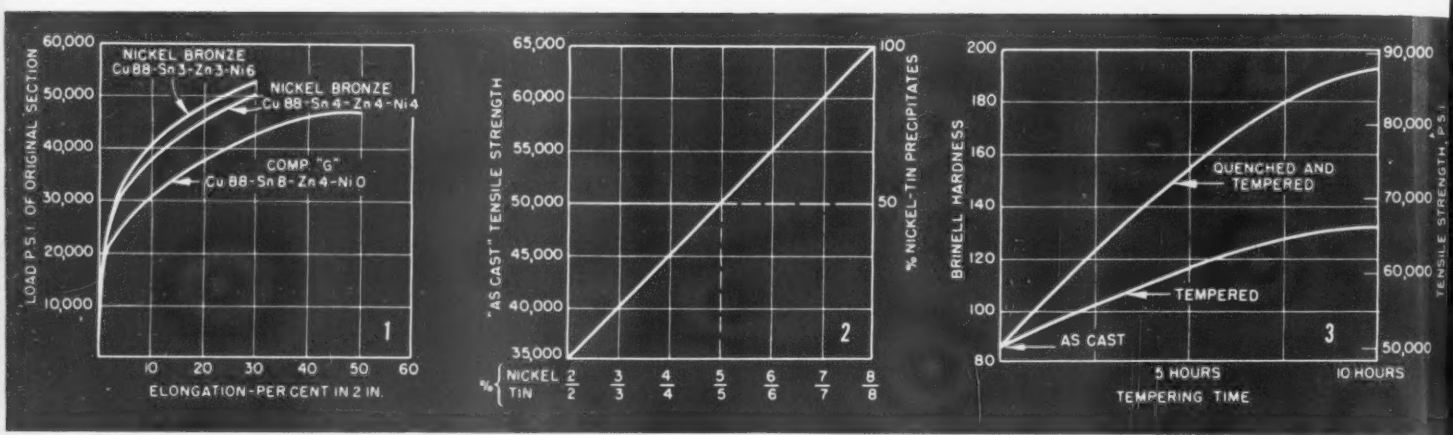

Fig. 1 — Strengthening effect of nickel in tin bronze of the composition "G" type (Tibbetts)

Fig. 2—Structural composition and strength of nickel-tin bronze. Fig. 3—Ni-Vee bronze heat treated

Properties and applications of the copper-base alloys known as the Ni-Vee bronzes are described in this fourth of a series of articles. These bronzes are based on the presence of 5 per cent nickel and 5 per cent tin, although the percentages may be varied for specific purposes, and lead and zinc may be added in certain analyses

THE NI-VEE* bronzes are a family of copper-base alloys whose composition is pivoted around the presence of 5 per cent nickel and 5 per cent tin. Greater or lesser amounts of these two constituents may be used for specific purposes. Lead and zinc may be added for reasons of economy, machinability or bearing-metal quality, with a corresponding sacrifice in mechanical properties or corrosion resistance. (Note: Ni-Vee bronzes containing lead and zinc are correspondingly marked—viz, Ni-Vee L5Z5 for 5 per cent lead and 5 per cent zinc. "HT" may be appended, indicating heat treatment.)

Foundrymen who are equipped to heat treat and control these alloys are instructed, if necessary, in their manufacture, and authorized to make them to the Ni-Vee specifications. Certain of the compositions are not only cast but may be forged and rolled. Others may be made by the various casting processes as well as in powdered metal forms. The following discussion will be limited to the ordinary sand-cast foundry products.

Foremost among the engineering advantages of Ni-Vee bronze are its easy castability, low shrinkage, pressure tightness, fine grain, economy and versatility. It is unique among brass foundry alloys because of its low-shrinkage characteristics. It, therefore, can provide the "high-strength" properties of the "high-shrinkage" alloys in castings composed of a "low-shrinkage" product. Its versatility is exhibited in its ability, like steel, to be used for its basically favorable properties as cast or as heat-treated (after machining, if desirable) for high strengths or high hardnesses.

The field of innumerable bronze compositions may be simplified into a few whose surprisingly good casting habits in the foundry appeal to the foundryman, while their strength range of 20,000 to 90,000 psi and related mechanical properties cover a much wider field of engineering applicability than the corresponding red brasses and bronzes. The sum-

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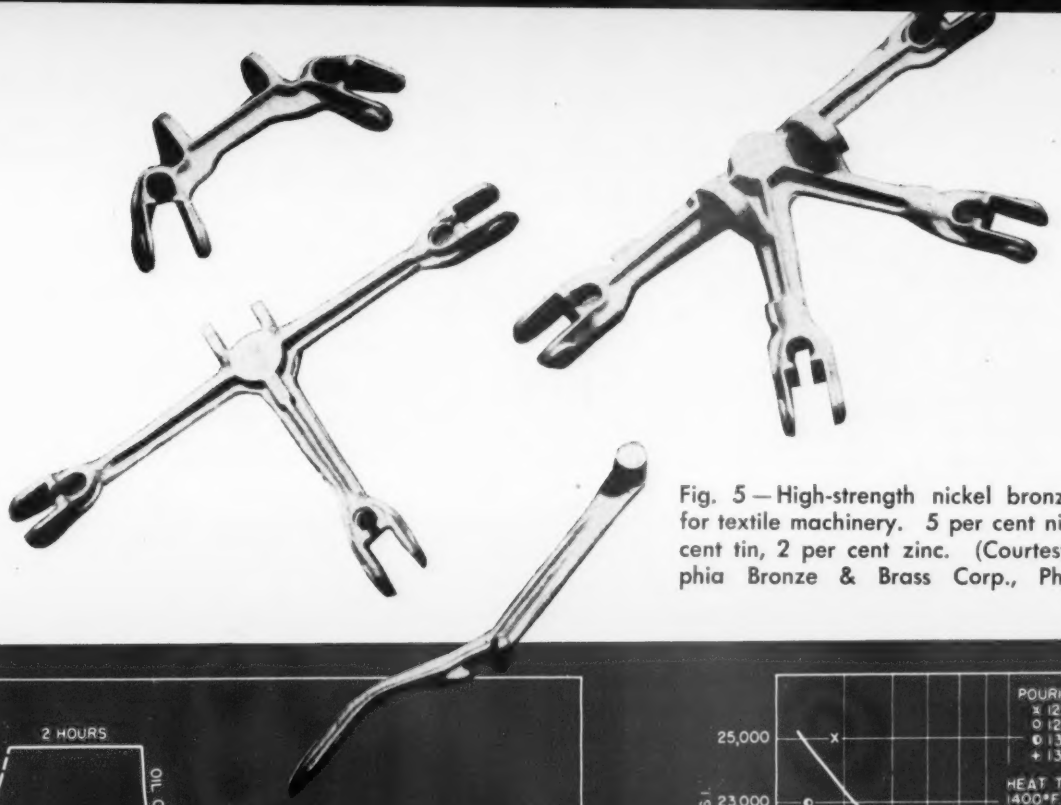


Fig. 5 — High-strength nickel bronze castings for textile machinery. 5 per cent nickel, 5 per cent tin, 2 per cent zinc. (Courtesy Philadelphia Bronze & Brass Corp., Philadelphia)

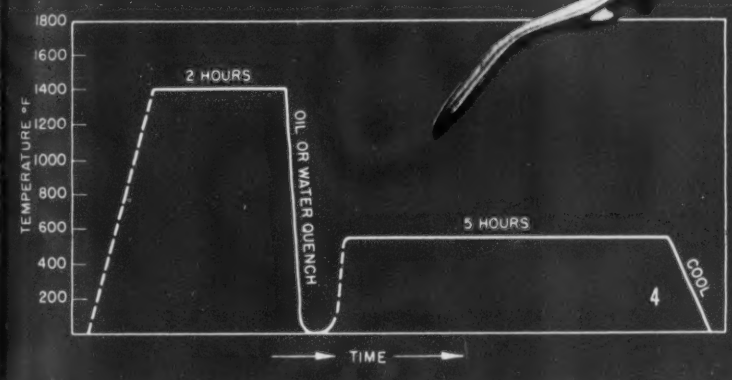


Fig. 4 — Diagram illustrating the heat treatment of 5 per cent nickel 5 per cent tin bronze

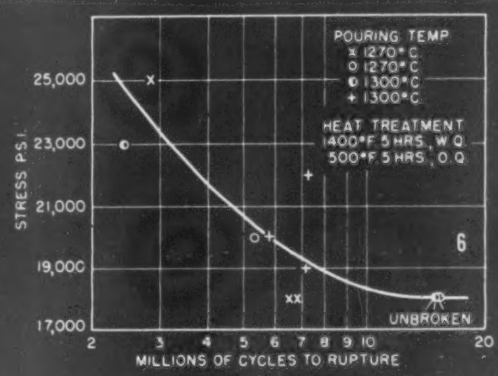


Fig. 6 — Fatigue strength of cast and heat treated 7.5 per cent nickel, 8 per cent tin alloy

mary in Table I presents the pattern.

The classification in Table I is an arbitrary one and, as in the case of red brasses, the applications may overlap whenever mechanical properties are adequate. For example, members of the "constructional" group may be used for bearings, and members of the "pressure" group for constructional purposes. This last mentioned switch is, in fact, an inviting one because a single metal mix in the foundry with an "ounce metal" (85-5-5-5) base may be processed either into pressure castings or by a tempering heat treatment into castings possessing Gun Metal (88-10-2) strength with "ounce metal" castability. Alternately, an as-cast product containing 1 per cent lead with the 5 per cent nickel and 5 per cent tin has been made to pass "G" Bronze specifications, as will be pointed out later.[1]

Properties and Applications—Tibbetts[2] came close to illustrating the properties obtainable in a 5 per cent nickel, 5 per cent tin bronze as cast, as shown in Fig. 1.

A survey of test bar shapes at the Canada Bureau of Mines,[3] Ottawa, Canada, developed the results shown in Table II.

In production, as well as in application to service, the Ni-Vee bronzes are divided over the matter of their lead content. For top strength and maximum hardness after heat treatment, it is necessary to melt down ingredients which are lead-free under conditions in which tools and equipment do not contaminate the metal with lead in excess of 0.01 per cent. Reasons for these requirements will be mentioned later.

Briefly, the effect of nickel in the Ni-Vee bronzes is based upon the metallurgical fact that nickel and tin form a constituent which is completely soluble in the liquid metal but possesses a limited solubility in the solidified metal. Fig. 2 illustrates diagrammatically the strength obtainable against the quantitative proportion of precipitation product available. Just as in carbon steels, a substantial degree of improvement in mechanical properties is obtained by increasing the carbon content from 0 to 0.30 per cent and obtaining a high strength with a pearlite-saturated structure at 0.85 per cent carbon; so, too, in the nickel-tin bronzes, the action begins at a level of 2 per cent nickel and 2 per cent tin, then achieves its optimum effect at about 5 per cent nickel and 5 per cent tin, and its maximum effect at 8 per cent nickel plus 8 per cent tin. The improvements apply

to a wide variety of the as-cast products.

Further improvements in strength and hardness can be achieved by heat treatment, as in the case of steels. Where carbon dissolves and diffuses rapidly in steel, the corresponding solution, diffusion and precipitation of the nickel-tin phase in the copper-base alloy is slow. This feature becomes extremely useful in enabling castings to be moderately strengthened by tempering only without recourse to the quenching treatment. In Fig. 3 the strength and hardness obtained in material that is only tempered after casting is charted in the lower line. The higher values shown in the upper line are procurable in the quenched and tempered product. A short effective quenching and tempering heat treatment is sketched in Fig. 4.

While most castings are used as cast, many would be heat-treated to develop maximum strength and hardness.

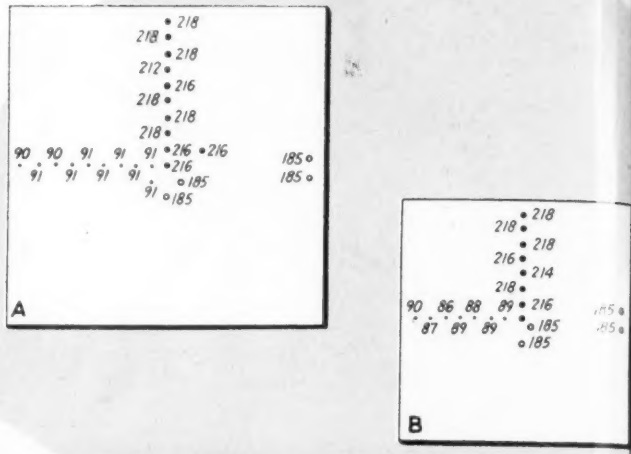
Dunlop[4] shows that heat-treated bronze of the Ni-Vee type can be made to excel some of the manganese bronzes and deliver a 50 per cent greater yield strength for the same tensile strength, as shown in Table IV. (See Fig. 5). Castings subjected to a steady high load or to fatigue loads find the heat treated product distinctly advantageous. A fatigue strength of approximately 18,000 lb is obtainable for the heat-treated product. This result is subject to improvement with modifications in heat treatment (Fig. 6).

The resistance to deformation is correspondingly high in the heat-treated bronze, and in the hardened condition it challenges the hard, rigid tin bronzes which contain tin contents of 15 to 20 per cent. A high order of uniformity in hardness is expected as shown in Fig. 7.

Dunlop confirms the occurrence of uniformity in hardness for sections up to 4 in. thick (Fig. 8). High hardnesses are usually desirable for wear resistance for such parts as cams, dies, gears, valve disks, valve seats, etc. (Fig. 9). In some cases, maximum wear resistance is sufficiently in demand to justify the production of maximum hardness at the expense of toughness. Parts such as valve seats may be processed in this way and embedded or supported by a tougher backing material to provide any necessary plastic flow. The type of casting shown in Fig. 9 illustrates this point. The material is used to provide a well-balanced combination of hardness and resistance to wear, fatigue and corrosion. The works specification follows[5]:

Pump valve material—Copper 83-85 per cent, tin 6-8 per cent, nickel 6-8 per cent, zinc 1-2 per cent, Brinell hardness 225. Heat treatment: Water quench from 1400° F followed by tempering at a temperature of 750° F.

Leaded Ni-Vee Bronzes — Many foundrymen may find the production of a practically lead-free product a distinct hardship. It is a requirement that must be met in some degree in the daily manufacture of all of the closely controlled or high-strength cast bronzes. Lead depreciates the mechanical properties of these alloys at room temperature and especially at elevated temperatures because it forms an inert



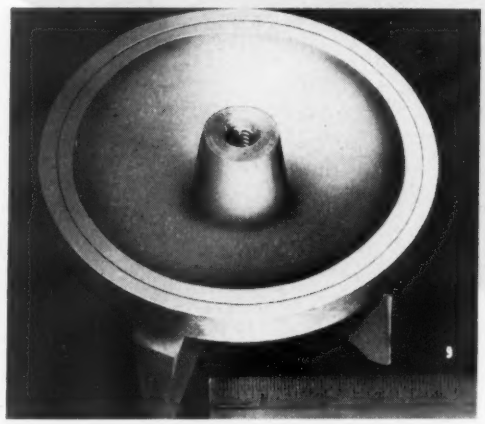


Fig. 9 — Bronze valve casting heat treated for high hardness. (Courtesy Worthington Pump & Machinery Corp.)

and low melting point ingredient in the microstructure. Against this disadvantage, there are compensating advantages which lead contributes. The as-cast leaded Ni-Vee bronzes thus come within the compass of all nonferrous foundrymen. Distinct advantages to the foundryman develop from the fact that the castability, fluidity and solidity are substantially improved.

The contribution to machinability, plasticity and resistance to wear or seizure which lead makes to bronze castings, at the expense of strength and ductility, is also realized in the Ni-Vee bronzes. However, there is an important difference. The as-cast strength of the leaded alloy may be increased by a tempering heat treatment into the higher strength values that are characteristic of lead-free material, and the product correspondingly up-graded. For example, a tempered casting of 10 per cent lead, Ni-Vee bronze can be made to possess the as-cast strength of a 5 per cent lead bronze. By the same procedure, a 5 per cent lead, Ni-Vee bronze may be tempered to approach the tensile properties of the as-cast lead-free product. The properties procurable

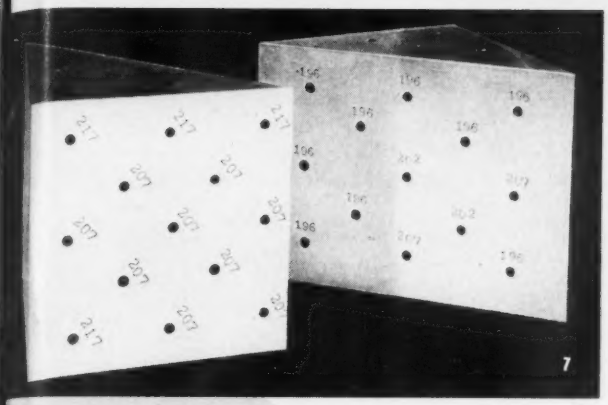


Fig. 7—Hardness across midsection of 4-in. cube of Ni-Vee bronze. Water quenched after 1 hour at 1400°F, followed by tempering 8 hours at 600°F

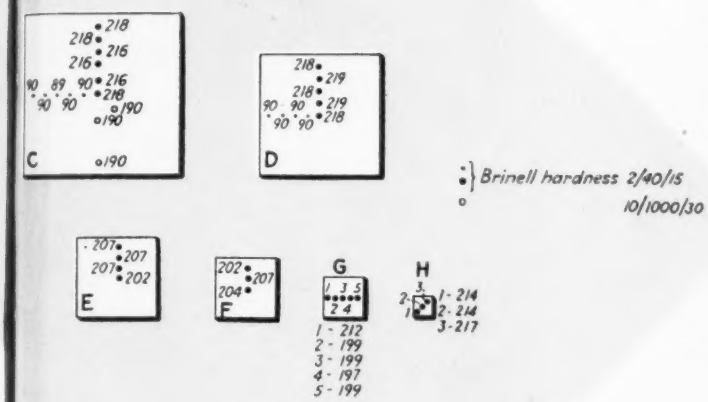


Fig. 8—Sections up to 4 in. are satisfactorily heat treated (Dunlop). Lower figures are as-cast values; higher figures are after full heat treatment

are summarized in Table I and have been mentioned in other references.[6]

Kihlgren[7] determined the effect of lead up to 1 per cent upon the as-cast properties of Ni-Vee bronze (Table III).

Portman[1] obtained somewhat better values for lead contents of 0.50 to 1.0 per cent with 4 per cent nickel and 4 per cent tin, and pointed out (Table V) its ability, as-cast, to meet the prevailing requirements for Navy Specification for Gun Metal (Composition "G"). He reported favorably upon its good surface appearance, machinability, pressure tightness and microstructure, as compared to ounce metal, and mentioned that it excelled the 85-5-5-5 alloy in mechanical properties (Table VI and Fig. 10.)

Figs. 12 and 13 from Hudson's[8] work, illustrate typical as-cast mechanical properties for pressure casting material of the 85-5-5-5 type, alloyed with 5 per cent nickel.

Heat treating ordinary red brass by quenching ruins its mechanical properties. Annealing or air cooling contributes very little value. Table VIII illustrates these points.[9]

The Ni-Vee L5Z5 (80-5-5-5-5 Ni) alloy responds much more favorably to the milder heat treatments and in most cases adequately to the simple 550° F tempering after casting.

Hudson[8] points out that these alloys retain their hardness at elevated temperatures which makes them useful for resisting wear as in steam piston and packing ring applications. Other high temperature applications among the pressure castings may need to be confined to temperatures under 450° F or to nickel additions of less than 3 per cent until more information is available regarding long-term exposure to elevated temperatures.

The engineering opportunities open to an alloy of the Ni-Vee L5Z5 type which may be processed over a wide range of mechanical properties, are obvious. Foundrymen can pour a single standard composition possessing excellent foundry habits. Most castings will be used as-cast. Mechanical properties as-cast will fall in the range reserved for its more refined companions, the high tin and very low lead content bronzes. Applications which require greater strength or hardness from castings of the same pattern, can be processed through a heat treatment applied in the foundry or in the shop, upon castings taken from inventory stock. This group comprises the pressure-resisting castings such as pumps, valves, regulator bodies, fittings, plumbing fixtures, etc,

High-Lead Ni-Vee Bronzes—Similar comments apply to the high lead (10 per cent or more lead) bearing metals of the Ni-Vee type. Since lead is an inert ingredient in the structure of these alloys, there are good prospects for the matrix metal to be enriched in nickel and tin by the amount of lead present. A Ni-Vee bronze of the L10 type containing 5 per cent nickel, 5 per cent tin and 10 per cent lead might be expected to possess a 10 per cent enrichment in nickel-tin component with a matrix containing 5.5 per cent nickel and 5.5 per cent tin.

In addition to the tabulation classified and summarized in Table I of this article, the data in Table IX from current work should be indicative of the properties procurable in the as-cast and heat treated Ni-Vee high-lead bronzes.

The effect of high lead contents upon tensile properties, is apparent. In a simplified picture of the structure, each grain of Ni-Vee alloy matrix is partly encased in a cellular envelope of lead. The Ni-Vee grain contributes the resistance to wear, corrosion, deformation and fatigue, while the lead provides embedability and plasticity in the manner of a lead-base babbitt. For application as bearing metals, most of the high-lead types operate under compressive loads. The greater resistance to deformation or load-carrying ability of the heat-treated, high-lead Ni-Vee bronze under compression is illustrated in Table VII[10].

Increasingly lead contents bring about foundry problems of eliminating lead segregation and "sweat." Low pouring temperatures and chill casting help. These devices assist in providing a quenching effect upon the casting which puts it in better condition for a heat treatment if desired. The 550 to 575°F heating, if applied, is enough below the

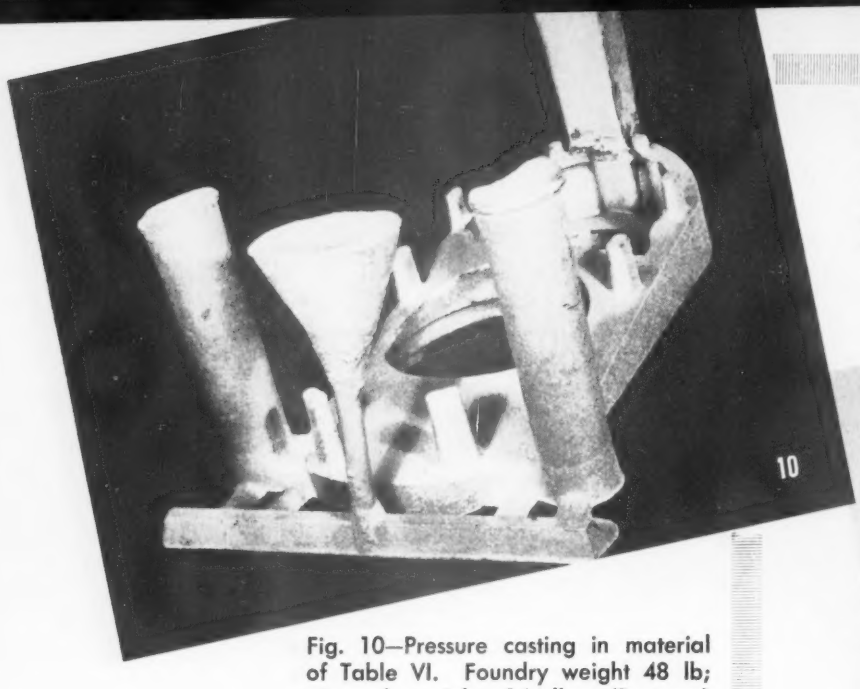
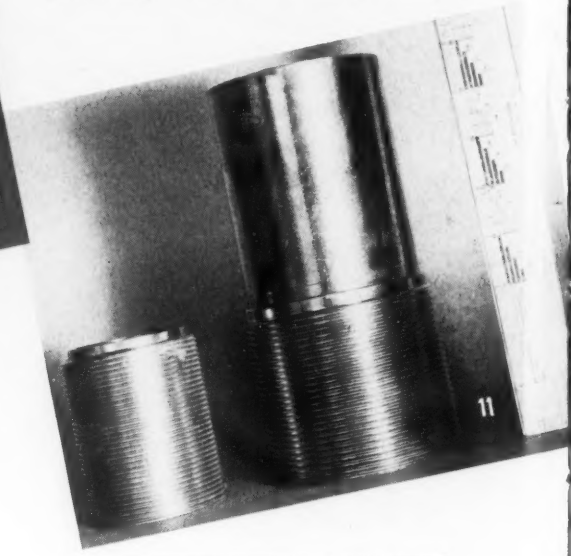


Fig. 10—Pressure casting in material of Table VI. Foundry weight 48 lb; trimmed weight 24 lb. (Portman)

Fig. 11—Landing gear nut for aircraft, made of Olds bearing bronze. Example of leaded-nickel bronze alloy. Also used in bomb hoists, bomb bays and cowling connections. (Courtesy Olds Alloys Co., South Gate, Calif.)



melting temperature of lead to avert any redispersion of it, while processing the casting into its harder and stronger condition.

Summary—By heat treatment, a soft, high-lead, plastic bearing of the Ni-Vee L-15 type may be made into a harder, wear-resisting product suitable for the more heavily loaded thrust bearing, without diminishing its lead content, which may be desirable in the case of bearings. Ni-Vee L10 with 10 per cent lead may be processed into tensile strengths comparable to those of the as-cast 5 per cent leaded Ni-Vee bronze, while Ni-Vee L5, in turn, can properly aspire to develop properties obtainable as cast in only the lead-free Ni-Vee bronze. This chain-ascension toward higher strengths and hardnesses for the Ni-Vee series, in which each member marks up its strength 30 to 60 per cent when heat treated, culminates in the 90,000 psi tensile and 180 bhn values of the quenched and tempered leadless Ni-Vee product. At this point, Ni-Vee bronze invites the foundryman to deliver "high-shrinkage" alloy properties with a "low-shrinkage" alloy material.

Conclusion—This description is a part of the record. A sequel to it dealing with the mechanism of changes in Ni-Vee bronze structure will be described briefly in another article. Much of the research work upon which this article is based was done by Messrs. Eash, Wise, Kihlgren and G. L. Lee of the International Nickel Co. research staff.

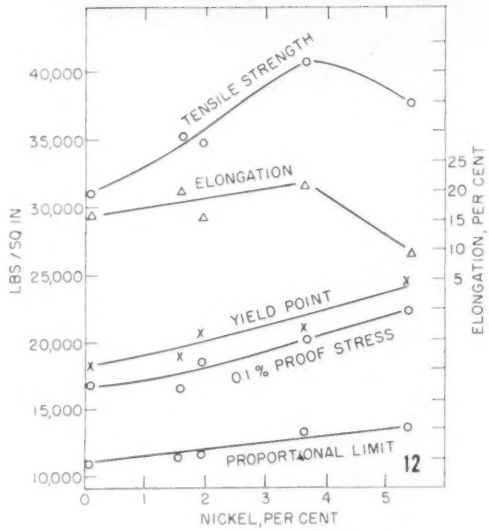


Fig. 12—Effect of nickel on properties of bronze containing 6-7 per cent tin, 4-5 per cent lead, 4-5 per cent zinc

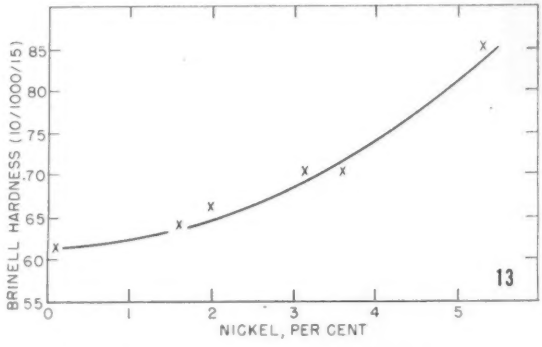


Fig. 13—Effect of nickel on hardness of bronze containing 6-7 per cent tin, 4-5 per cent lead, 4-5 per cent zinc

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TABLE I—Simplified Classification of Nickel-Tin Bronzes

	Copper	Nickel	Tin	Lead	Zinc	Tensile Strength	Elongation	Bhn	Remarks
-Vee	88	5	5	..	2	50,000	40	85	CONSTRUCTIONAL BRONZES: Suitable for gears, cams, valves, constructional castings, etc. "G" Bronze, 88-10-2 Type, ASTM Specification B143-49T (See A)
-Vee-T	Same as Ni-Vee, Heat Treated (b)					65,000	10	130	
-Vee-HT	Same as Ni-Vee, Heat Treated (a)					85,000	10	180	
	88	1	10	..	2	40,000	18	..	
-Vee-L5Z5	80	5	5	5	5	40,000	20	80	PRESSURE CASTINGS: Suitable for pumps, valves, fittings, plumbing goods, etc. Ounce Metal, 85-5-5-5, ASTM Specification B145-49T (See B)
-Vee-L5Z5-HT	Same as Ni-Vee-L5Z5, Heat Treated (b)					50,000	5	120	
	85	2.5	2.5	5	5	35,000	30	60	
	85	1	5	5	5	30,000	20	..	
-Vee-L10	80	5	5	10	..	35,000	10	80	LEADED BEARING BRONZES: Suitable for bearings, bushings, anti-friction metal, etc. Also as acid-resisting bronze for corrosion resistance in acids, mine water, sulfite paper, etc. 80-10-10 type, ASTM Specification B22-49T (See C)
-Vee-L10-HT	Same as Ni-Vee-L10, Heat Treated (b)					40,000	5	110	
-Vee-L20	70	5	5	20	..	25,000	10	70	
-Vee-L20-HT	Same as Ni-Vee-L20, Heat Treated (b)					30,000	5	80	
	80	..	10	10	..	.....	..	..	

a)=1400° F 6-10 hrs., water quench, and 600° F temper for 6-10 hrs.
b)=Temper (only) for 6 to 10 hours at 575° F.

TABLE II—Range of Tensile Properties for Nickel-Tin Bronze* in Several Test Bar Shapes

pe Bar	Ultimate Tensile Strength	Yield Strength .20% Offset	Elongation	Reduction of Area
ow	49,000-53,000	20,000-21,000	40-48	38-47
ash	50,000-54,000	23,000-24,000	30-35	30-35
ebbert (Crown)	49,000-50,000	22,000-22,400	35-40	38-44

* 5 per cent Ni, 5 per cent Sn, 2 per cent Zn, balance Cu

TABLE III—Effect of Lead on Nickel-Tin Bronze

Lead, %	Tensile Strength, psi	% Elongation in 2"
0.00	47,150	45
0.25	42,900	22
0.50	37,800	16
1.00	39,850	16

TABLE IV—Properties of Nickel-Tin Bronze and Manganese Bronze (Dunlop)

lloy	Condition	Brinell Hardness 3/40/15	Proportional Limit, psi	Yield, ½% Elongation Under Load, psi	Tensile Strength, psi	Elongation in 2", %	Izod, ft lb
ickel bronze*	5 hr 1400° F, W.Q. + 5 hr 490° F, W.Q.	103	22,400	31,800	49,700	38	36
	5 hr 1400° F, W.Q. + 5 hr 570° F, W.Q.	156	37,600	47,500	76,600	18	24
	5 hr 1400° F, W.Q. + 5 hr 660° F, W.Q.	191	53,600	68,500	85,100	5	11
anganese bronze**	"As cast"	124	15,200	30,000	73,500	29	23

* 88 Cu, 5 Ni, 5 Sn, 2 Zn
* 58.87 Cu, 0.38 Sn, 0.10 Pb, 1.12 Fe, 1.03 Al, 1.00 Mn, balance Zn
Q.=Water Quench

TABLE V—Comparison of Leaded Ni-Vee Type with Navy "G" Bronze

	Ni-Vee (c) Range	Ni-Vee (c) Average	Navy Dept. Spec. 46-M-6 Comp. G Modified (d)
ensile strength, psi ..	40,400-47,500	44,550	40,000 min.
ield strength, psi	17,250-21,800	18,850	.....
ongation in 2", % ..	22-44	34.6	20 min.
n (500 Kg)	53-74	60	.....
ecific gravity	8.53-8.77	8.67	.....

Approx. Composition:

	Copper	Nickel	Tin	Lead	Zinc
(c)	Bal.	4	4	1	4
(d)	Bal.	1	–	–	–

TABLE VI—Physical Properties of Test Bars

	Ounce Metal (a)	Nickel Bronze (b)
Tensile strength, psi	31,500-32,500	42,000-43,500
Yield strength, psi	14,000-16,000	18,000-19,000
Elongation in 2", %	22-24	26-30
Bhn (500 Kg. load)	48-52	52-56
Izod impact, ft-lb	8.0-11.0	11.0-14.0
Specific gravity	8.58	8.61

Composition:

	Copper	Nickel	Tin	Lead	Zinc
(a)	Bal.	–	5	5	5
(b)	Bal.	4	4	1	4

TABLE VII—Heat Treated Leaded Nickel-Tin Bearing Bronze in Compression

ondition	Proportional Limit, psi	Yield Strength .10% Offset, psi	Yield Strength .20% Offset, psi	Yield Strength .35% Offset, psi	Vickers Hardness, 20-kg Load
s cast	11,000	15,500	16,500	18,000	77
ged, 575° F, 10 hr	15,500	27,500	30,500	33,000	111

Castings supplied by the Olds Alloys Co., South Gate, Calif. Cu 60-65 r cent, Ni 5-6 per cent, Sn 5-6 per cent, Zn 9-11 per cent, Pb 17-19 r cent.

TABLE VIII—Heat Treatment of Red Brass (85-5-5-5 Type)

Treatment	Tensile Strength	Yield Point	Reduction of Area	Elongation in 2"	Fracture
"As cast"	37,840	17,850	27.5	32	(b)
Annealed (1200° F—15 min.—FC) ...	38,300	17,425	31	37	(b)
Annealed (1475° F—15 min.—FC) ...	37,440	16,985	34	37	(b)
Annealed (1600° F—15 min.—FC) (a)	36,040	16,240	30.5	33.5	(b)
Quenched (1475° F—15 min.—WQ) ..	14,270	13,270	0	3	(c)

FC=Furnace Cooled. WQ=Water Quenched.
(a) Specimens tended to bend under own weight in furnace at 1600° F. (b) The "as cast" and annealed specimens showed the reddish fine crystalline structure normal for the 85-5-5-5 alloy. (c) After quenching, the grain boundaries of the metal were distinctly visible on the oxidized machined surfaces, and fracture occurred through these boundaries.

TABLE IX—Typical Properties for Cast and Heat Treated High-Lead Nickel-Tin Alloys

Type	Copper	Nickel	Tin	Lead	Max Zinc	As Cast: Tensile Strength, psi	As Cast: Yield Strength, psi	As Cast: Elongation 2"	As Cast: Bhn	Heated 550° F for 10 Hr: Tensile Strength, psi	Heated 550° F for 10 Hr: Yield Strength, psi	Heated 550° F for 10 Hr: Elongation 2"	Heated 550° F for 10 Hr: Bhn
-Vee-L2	Bal.	5	5	2.5	.50	44,000	23,000	30	92	55,000	40,000	10	135
-Vee-L2-Z2	Bal.	5	5	2.5	2.0	42,000	24,000	25	90	49,000	35,000	8	120
-Vee-L5	Bal.	5	5	5.0	.50	41,000	20,000	22	92	47,000	35,000	7	130
-Vee-L10	Bal.	5	5	10.0	.50	38,000	22,000	18	86	44,000	30,000	6	108
-Vee-L15	Bal.	5	5	15.0	.50	30,000	21,000	12	78	35,000	24,000	5	88
-Vee-L20	Bal.	5	5	20.0	.50	27,000	20,000	10	70	30,000	22,000	4	80

Metallic and Nonmetallic

COATINGS FOR Gray Iron

By CHARLES O. BURGESS
Technical Director
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In this third and concluding article describing various types of coatings for gray iron castings, the author discusses organic finishes, chemical conversion coatings, coloring, and cement lining and armor

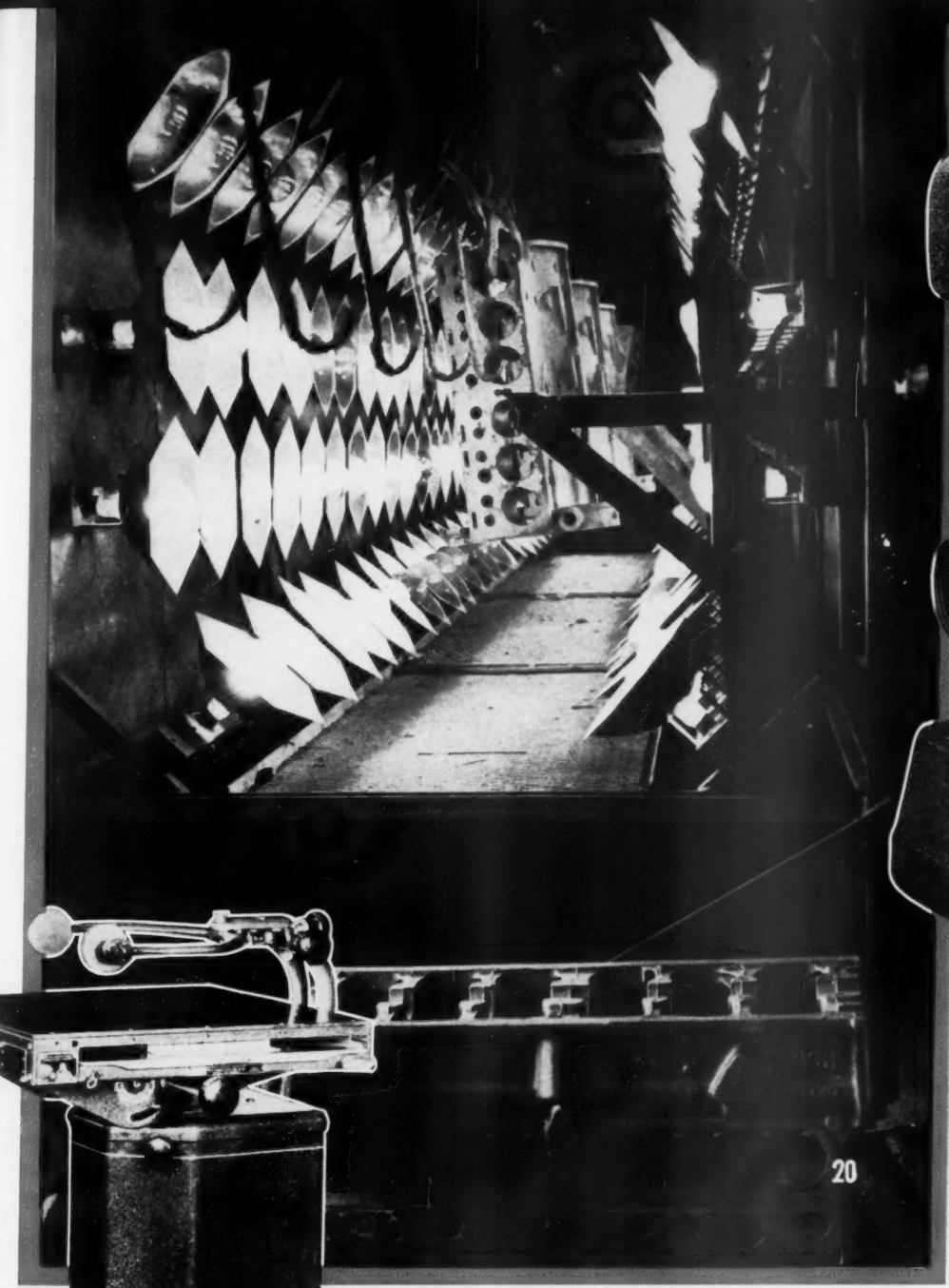
THE gray iron industry as a whole has not realized the great influence of appearance standards on favorable public appraisal of its product. However, some users and producers have recognized that organic finishes, commonly known as paints, lacquers or enamels, are among the most effective and convenient means of improving appearance and protecting the casting surface. As surface coatings for gray iron or other ferrous materials, such finishes form a continuous, inert film between the surface of the metal and the atmosphere, thus preventing contact with corrosive atmospheres, liquids or gases. The wide, almost limitless, variety in available colors and textures make such organic finishes by far the most attractive coatings for decorative purposes. In addition, they provide sanitary, easily cleaned surfaces and increase safety by exhibiting a high order of light reflection.

At the risk of oversimplification, an attempt will be made to list organic types of finishes widely used to coat gray iron, as well as to describe briefly those that show particular promise for future application to gray iron. Oversimplification is possible since the field of organic finishing is a complex one which is expanding rapidly, and, as is usual in such cases, it is often difficult to evaluate the many new materials appearing on the market, or to make a final choice of the best finish for a given application. Even the technical terminology is by no means standardized, and such terms as "paint," "enamel" or "lacquer" may mean entirely different things to different groups of specialists. Under such circumstances, it is necessary, in addition to noting characteristics of commercial importance, to identify the constituents typically present in the three main types of organic finishes both as a matter of general information and to permit the purchaser to critically judge the worth of new products offered to him.

Classification of Organic Finishes—Organic finishes for gray iron may be divided into three general classes on the basis of the vehicle employed[70, 71].

Oleoresinous or varnish-base paints are composed of drying oils (linseed, tung, soya, etc.), natural and/or synthetic resins, and pigments. Petroleum thinners, metallic driers and other special agents are

Fig. 18—Knife-bar casting after sand blasting, snagging and grinding. The same casting, primed, filled, sanded and sealed, is shown in Fig. 22



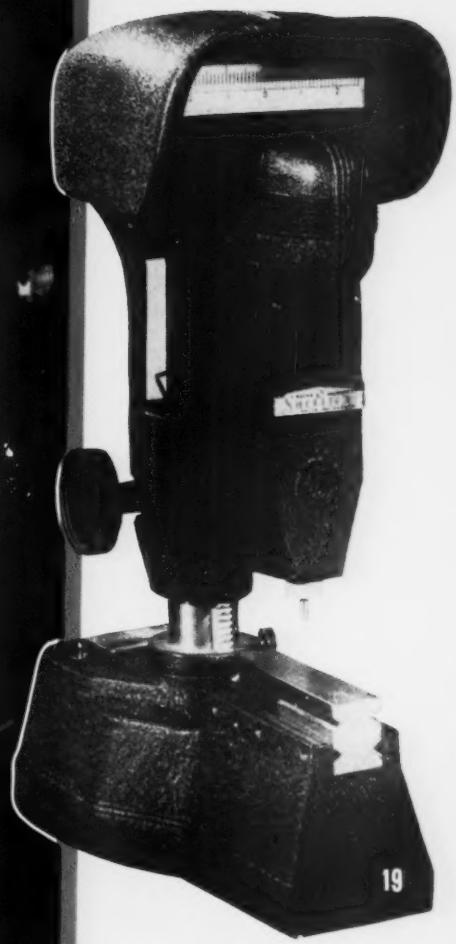


Fig. 19 — A coarse-grained wrinkle finish was used on the gray iron base of this gage

Fig. 20—Corrosion-inhibiting primer on gray iron cylinder blocks being dried with infrared lamps

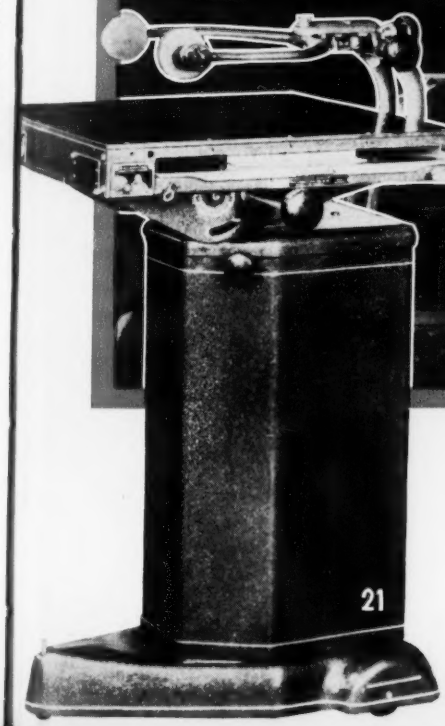
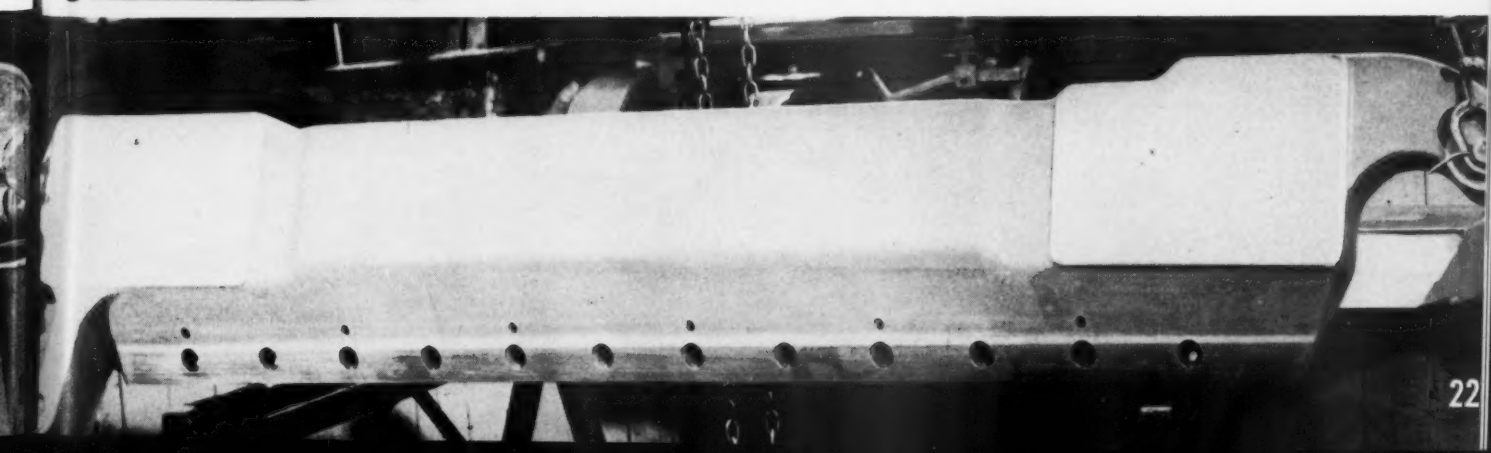


Fig. 21—A spatter finish provides excellent protection and eye appeal to this x-ray stand



usually added. Of the three basic types, this finish is the oldest, most orthodox type, the slowest drying, even if baked, and the least expensive of those commonly used on gray iron today. High solids content permits deposition of heavy films, but color retention under heat, chemical resistance and film quality are only fair. Although oleoresinous finishes are still in use there is a tendency commercially to convert to the more rapidly drying lacquers or synthetic finishes[72].

Lacquers generally consist of nitrocellulose resins, plasticizers and pigments dissolved in volatile organic solvents of the ester and alcohol types. The paint film is formed on the evaporation of these volatile solvents. Lacquers are the fastest of air dry finishes and may be force dried at temperatures up to 180° F. The quick-drying qualities of lacquer at room temperature have resulted in their wide application in industrial processes where speed of finishing is of prime importance. In recent years, improvement in the toughness, durability and chemical resistance of lacquer films has added to their commercial usefulness. Because of thin film characteristics, they are normally used over a primer and/or filler.

Synthetic resin base paints consist of one or more of the many varieties of synthetic resins, combined with pigments and drying oils for the nonvolatile portion. Volatile petroleum or coal tar solvents or thinners are employed. Many types of synthetic finishes (for example, phenolic, alkyd and vinyl) have been developed for specific applications. Synthetic finishes are intermediate in air drying rate between oleoresinous and lacquer finishes. They can be baked at comparatively high temperatures (usually 200°-350° F), and consequently lend themselves to fast production schedules which, in certain cases, will compete with lacquer speed of drying. They are, in general, tougher and more resistant to chemicals than either oleoresinous or lacquer base finishes. Unusually good film life and quality is exhibited whether air dried or baked.

The above three types of finishes cannot always be sharply divided. Combinations of two of them may often be more valuable for a specific purpose than one of them alone. For example, the finish resulting from the addition of synthetic resins to lacquer seems to combine many of the desirable features of these two materials[70].

Omitted in the preceding discussion of these three main types is the finish commonly referred to as oil-type paint[70], consisting simply of a pigment, drying oil and suitable solvents. This paint type is gradually being superseded by the three types already described and is not widely used on gray iron, except for large outdoor pieces which cannot be easily moved or in the formulation of corrosion-inhibiting primers.

The above division of paint into three types was made on the basis of the composition of the vehicle which carries the pigment. It should be understood, however, that within a given class or type the pigment-binder ratio, i.e. the amount of pigment in relation to the amount of non-volatile solids in the vehicle, can be altered to meet a specific application. For example, with a given paint a low pigment-binder ratio will be selected if a high gloss typical of an enamel is desired, whereas a high pigment-binder ratio is chosen if filling qualities are more important than a brilliant gloss[73].

Special Texture Finishes—In recent years much progress has been made in developing attractive finish coats for gray iron which eliminate the need for an expensive finishing system that involves extensive filling, smoothing and sealing operations. These one or two-coat finishes provide at a very moderate cost a degree of protection adequate for most industrial purposes, and greatly im- (*Please turn to page* 226)

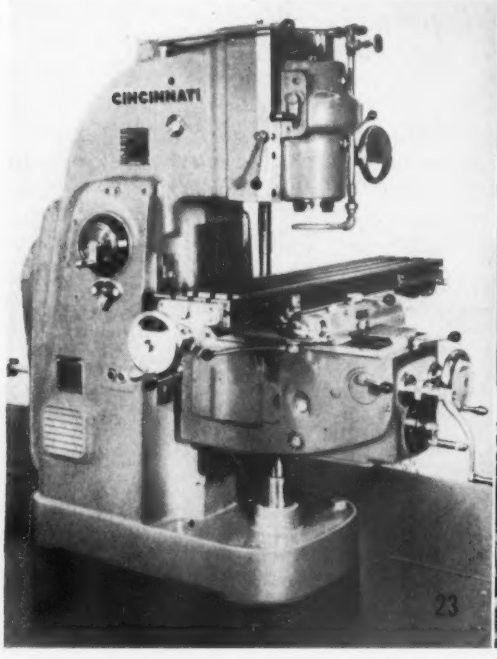


Fig. 23—Milling machine with lacquer-base finish

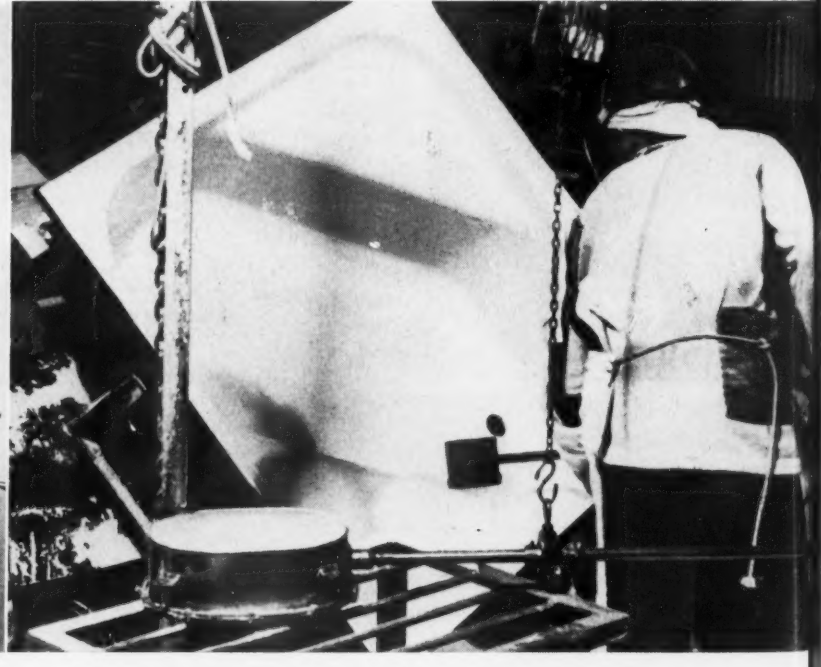


Fig. 24—Dusting finish enamel coat on a bathtub

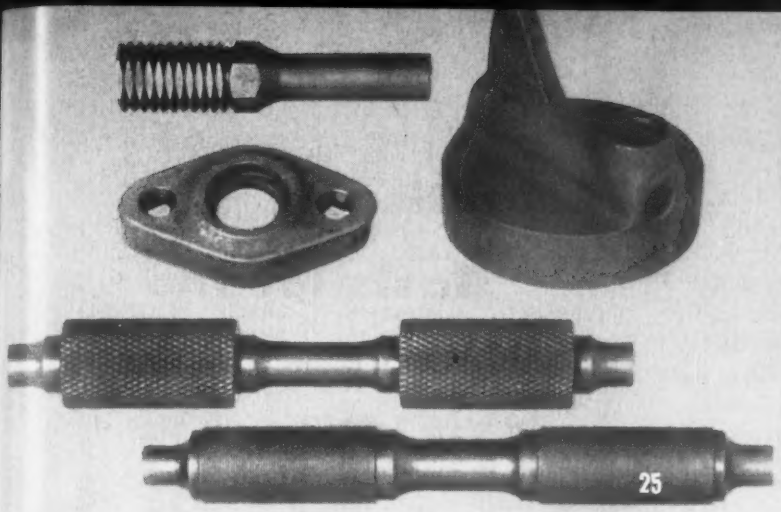


Fig. 25—Castings blackened in as-cast and machined conditions

Fig. 26—This precision instrument has been given a two-coat "hammered" finish. It provides an easily cleaned surface

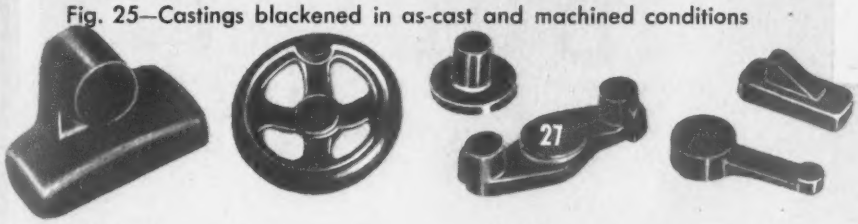
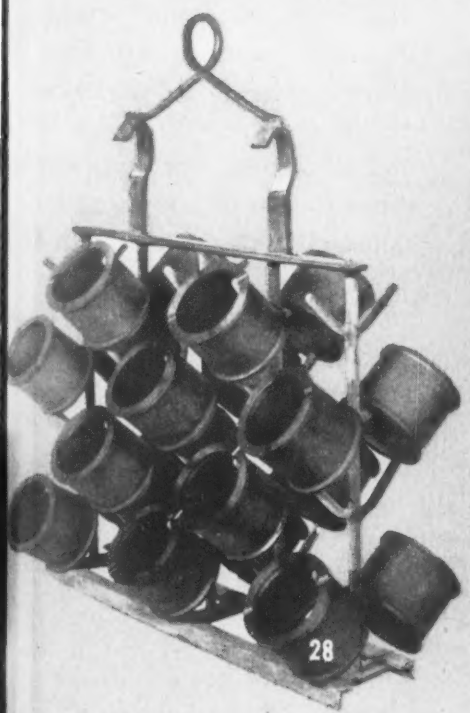


Fig. 27—Black oxide coating gives attractive surface finish



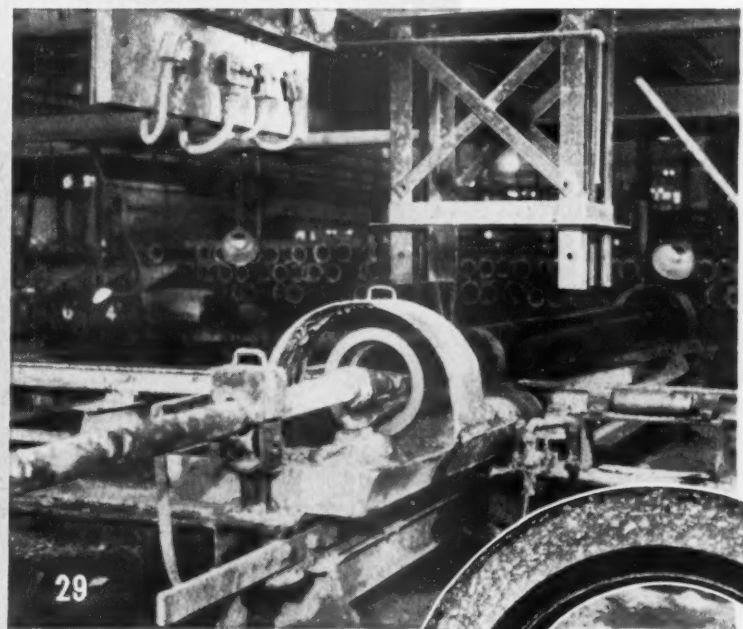


Fig. 28—Cast valve guides racked for phosphate immersion treatment to improve their wear resistance. Fig. 29—Manufacturing cement-lined pipe

Fig. 30 — These famous Lamprecht castings were given an unusual brilliant black finish

Fig. 31 — Cross section of cement-armored pipe

A Theoretical Basis for the Design of

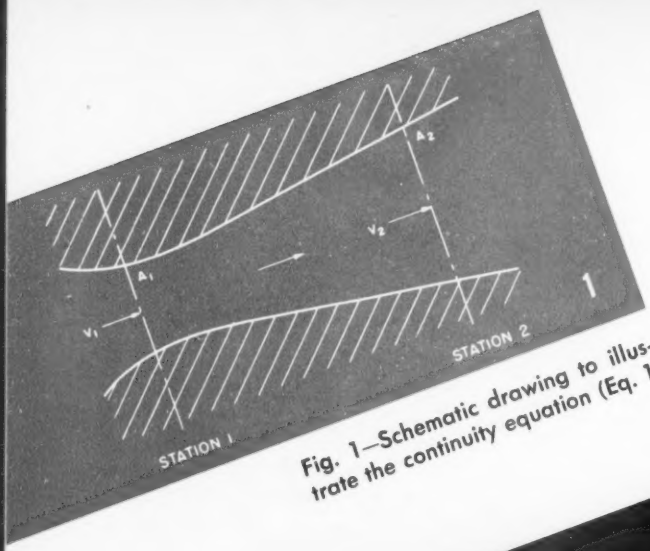


Fig. 1—Schematic drawing to illustrate the continuity equation (Eq. 1)

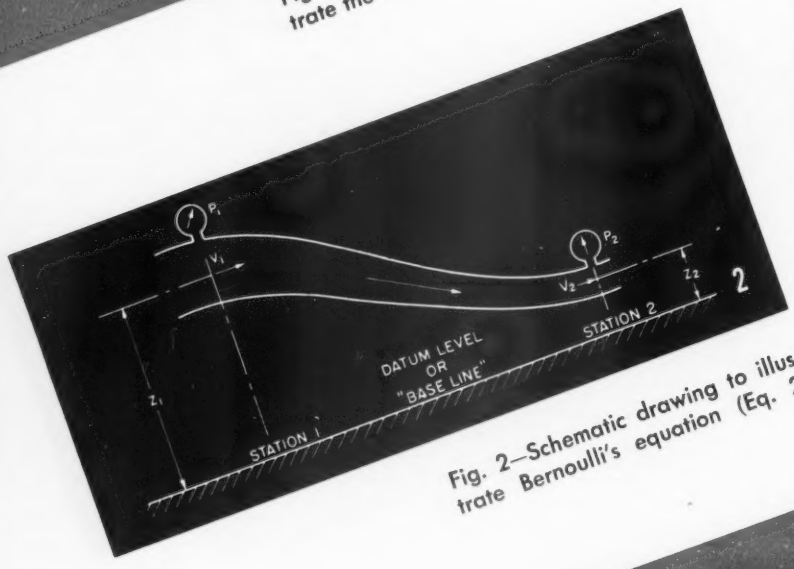


Fig. 2—Schematic drawing to illustrate Bernoulli's equation (Eq. 2)

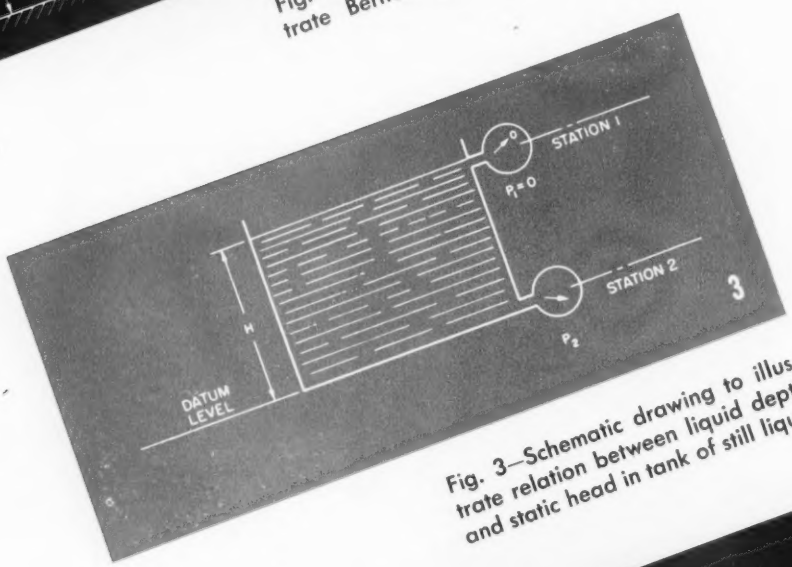


Fig. 3—Schematic drawing to illustrate relation between liquid depth and static head in tank of still liquid

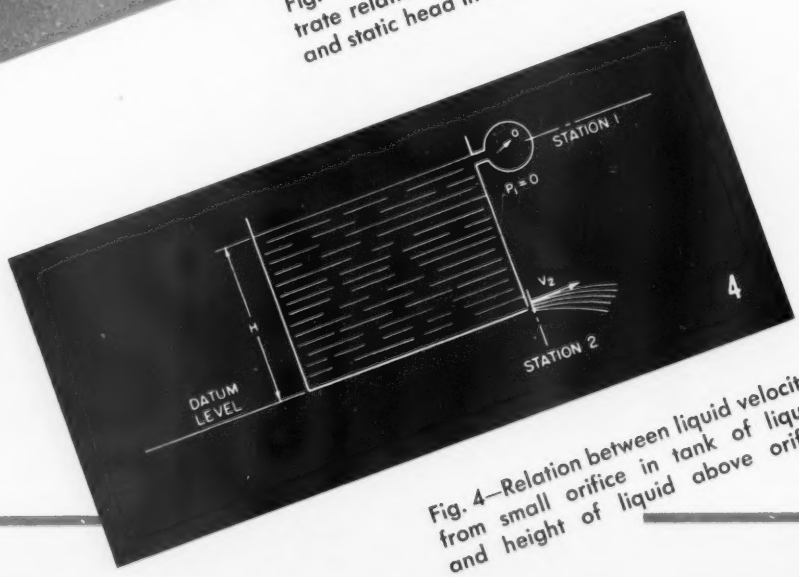


Fig. 4—Relation between liquid velocity from small orifice in tank of liquid and height of liquid above orifice

The authors explain how to predict qualitatively the behavior of liquid metal flowing from a manifold gating system of circular cross section. While this article does not suggest how to design gating systems, it describes a tool the foundryman can use in conjunction with his experience in gating practice

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Gates

ONE of the important factors in producing a casting is the choice and design of a gating system for the mold. The gate design is well known to affect the quality of a casting as evidenced by the presence or absence of various defects. Furthermore, the metal economy, or yield, is affected by gate design. Hence, considerable thought is given to the proper choice of various conventional gating techniques, and the use of split gates, step gates, choke gates, tangent gates, etc. is universal.

Success of a particular gating system is determined by the casting produced. Very often this method of hindsight has caused the foundryman to wonder why the proper gate dimensions cannot be computed so that he can approach the gating problem with greater assurance. The answer is that the future does hold such a promise, but a considerable amount of data must be collected.

One approach would be to measure such quantities as velocity and volume rates of flow in all parts of the gating system for every conceivable combination of sprue, runner and gate size. Even if experimentally possible such a task would last for generations. However, certain relationships that appear helpful for an understanding of the flow of molten metal in gates have been established in the field of fluid mechanics. With these relationships expressed mathematically, it is then possible to survey the various combinations encountered in gating systems to hope to obtain expressions that will predict their influence on the flow of the metal. Eventually, the fundamental information gained through such an analytical approach will lead to charts and figures which will guide the foundryman in his choice of a gating system.

This paper in particular will deal with the flow of molten steel through the manifold type of gating system, in which the sprue is offset from the gates. A few simple expressions to predict the flow distribution will be derived and then compared with results obtained from some experimental data. Only runners and gates of circular cross sections are considered. Since the discussion, in general, will deal with the dynamics of flowing liquids, it first may be well to present a short review of certain useful fundamental principles.

The Continuity Equation—The so-called law of conservation of matter states that matter neither can be made nor destroyed. It can be illustrated by Fig. 1. This is a drawing of a conduit with a variable cross section, filled with liquid flowing in the direction shown. The volume rate of liquid flow past station 2 will be equal to the volume rate of flow past station 1, or in other words, as much material leaves the system as enters it. Since the volume rate of flow is equal to the cross-sectional area times the stream velocity, we can write the above statements in mathematical form:

$$V_1A_1 = V_2A_2 \quad \text{(Eq. 1)}$$

This may be stated: "Velocity at station 1 times area of station 1 = velocity of station 2 times area at station 2."

In the foundry, this law finds its use in slag traps, for example, in which metal flowing with a high velocity is led into a comparatively large section in which the velocity drops, thus permitting dirt and slag to float to the surface.

The Law of Conservation of Energy—When filling a mold, the metal is usually introduced, or channelled, into the sprue through some sort of pouring cup. The level of the metal in the cup is usually kept at some more or less constant level above that of the mold cavity. From the pouring cup, the metal flows down through a sprue, and then through some kind of runner, with attached gates. The liquid metal gets its energy for flowing from the fact that it starts out at a relatively high point and flows to a relatively low point. When the liquid metal is in the pouring cup, it has potential energy due only to its *height;* as it flows down into the gating system, this potential energy is changed into energy of motion, the so-called *kinetic energy*. Also, the liquid in the runner and gates is under a certain pressure, due to the weight of metal above it. This pressure "pushes" it through the gates into the mold cavity. The original potential energy which the liquid possessed by virtue of its height is transformed into *kinetic energy* (energy of motion) and into "flow-work" energy (that energy required to push the metal into the cavity against the back-pressure existing there).

To be able to predict the actual flow through a gating system, it is necessary to know how the three forms of energy are related. To determine this relationship, the so-called law of conservation of energy, which is analogous to the law of conservation of matter, is used.

We are familiar, of course, with the statement

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Design of Gates

that "energy can neither be made nor destroyed, but only changed in form." This is one somewhat crude statement of the law of conservation of energy. As applied to flowing liquids, it implies that the *sum* of the three types of energy mentioned above (potential, kinetic and "flow-work") must be conserved from point to point.* That is, the sum of these three energies at one point in the stream must be equal to the sum at any other point in the stream. This statement tells us that these various forms of energy are inter-convertible; it does not tell us how. In order to know that, we will make use of Bernoulli's equation.

Bernoulli's Equation—In 1738, the Swiss mathematician, Daniel Bernoulli, derived the following equation (which will be explained presently).

$$wZ_1 + wp_1v + wV_1^2/2g = wZ_2 + wp_2v + w\,V_2^2/2g \quad \text{(Eq. 2)}$$

Where g = acceleration due to gravity, 32 ft/sec/sec
p = static pressure in the fluid, lb/ft²
v = specific volume of the fluid, ft³/lb
V = velocity, ft/sec
w = total weight of fluid flowing, lb
Z = height of liquid, ft

This equation is a very simple mathematical statement of the above mentioned law of conservation of energy, as it applies to liquids. We will not try to show how it was derived, but rather try to explain the physical meaning of the various terms. This may be done with the help of Fig. 2.

It will be noted that each side of Eq. 2 has three terms. Each term has the dimensions of weight times distance, or work, or *energy*. The term wZ_1 represents the work done in raising the w pounds of liquid to the height of Z_1 (*potential* energy at station 1). The term wp_1v_1 represents the work done in pushing w pounds of liquid into the entrance of the system against the pressure p_1 existing at that point (*flow-work* energy at station 1). The term $wV_1^2/2g$ represents the work necessary to give w pounds of liquid the velocity V_1 (*kinetic* energy at station 1).

The terms on the right-hand side of the equation refer to the various forms of energy at station 2.

Now it can be seen that Bernoulli's equation is in truth a statement of the law of conservation of energy. For it says that the total energy contained by the liquid at station 1 is equal to the total energy contained by the liquid at station 2.**

We are assuming that there is no addition or subtraction of energy to or from the system between stations 1 and 2, by pumps, turbines, etc. These would appear in a more general statement of Eq. 2, but they, of course, do not occur in a casting. Also, Eq. 2 does not take into account the gain or loss of energy in the form of heat. This effect, due to gain or loss of heat, is quite small in the cases we will consider, and we will not be appreciably in error in ignoring it. Friction and viscosity are considered later.

Let us first simplify Eq. 2 by cancelling w from both sides of the equation. We get:

$$Z_1 + p_1v + V_1^2/2g = Z_2 + p_2v + V_2^2/2g \quad \text{(Eq. 3)}$$

Now we see that all the terms have the dimension of length. In particular, the term pv is often written as h, and is called the "static head" or merely the word "head."

We now know, not only that there are three kinds of energy we must consider, and that the sum of these is constant, but it also tells us how one form is changed into another. A few simple examples may illustrate this.

Consider first, Fig. 3. This represents a tank of still water, filled to a height H, and with pressure gages at top and bottom. Let us call the top surface station 1, the bottom station 2. We let station 2 also be the datum level, so $Z_2 = 0$. Now, inserting the variables shown in Fig. 3 into Eq. 3, we get: $H + 0 + 0 = 0 + p_2v + 0$. Therefore, $p_2v = h_2 = H$. Expressed in words, "the 'head' of water at the bottom of the tank is the height of water in the tank."

In another example, consider the tank of water shown in Fig. 4. It is identical to that in Fig. 3, but it has a small hole at the bottom. We assign stations as shown in Fig. 4, and in this case Eq. 3 becomes: $H + 0 + 0 = 0 + 0 + V_2^2/2g$.

or $$V_2 = \sqrt{2gH} \quad \text{(Eq. 4)}$$

This is a familiar relation which was discovered by the Italian, Torricelli.

The Discharge Coefficient—The volume rate of flow, Q, through the above hole, or orifice, might be thought to be the product of the stream velocity, V, through the hole and the area, A, of the hole. Unfortunately, this is not quite true. For reasons which will not be given here, there is an empirical proportionality constant, k, and Eq. 4 becomes:

$$Q = kAV = kA\sqrt{2gh} \quad \text{(Eq. 5)}$$

Note that we are using the h in Eq. 5, rather than H. This is because in general the static head at a point is not equal simply to the height of liquid above it. Eq. 4 was written for a specific case in which it did; in general however, it is necessary to use the static head h in Eq. 5. The value of h can be computed from the liquid height H if the flows are known, by using the Bernoulli equation (Eq. 3).

The proportionality constant, k, called the "discharge coefficient," is less than 1, and represents the departure of the real system from an imaginary, "ideal" system. Suffice it to say that there is such a thing as a "discharge coefficient" and that it must be measured empirically for most orifices. However,

* This statement is not rigorously true. A more rigorous statement would be ". . . the sum of the three types of energy . . . . must be conserved from point to point along a 'streamline.'" For an explanation of this point, see Prandtl, L., Tietjens, O. G., *Fundamentals of Hydro- and Aeromechanics*, McGraw-Hill, New York, 1934, (pp. 107-114). However, for the purpose of this article, the statement made in the text will be considered rigorous enough.

** Once more, a more rigorous statement would include the condition "provided that station 1 and station 2 are on a streamline".

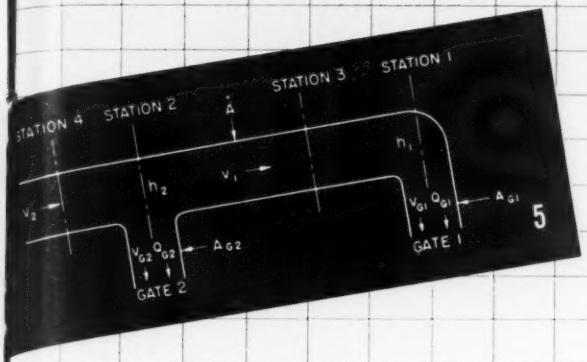


Fig. 5—Model used in development of equation for flow ratio from a runner with two gates

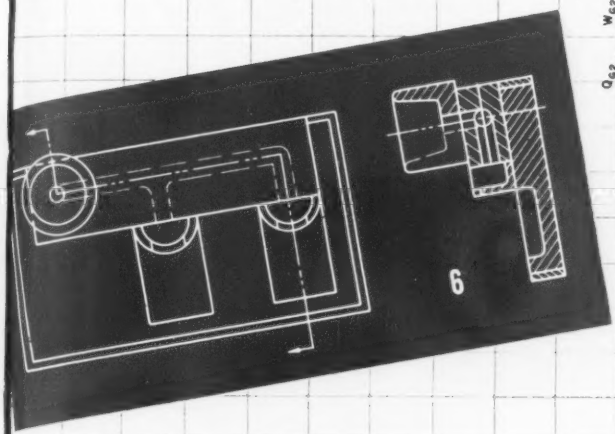


Fig. 6—Mold assembly used in measurement of discharge ratios

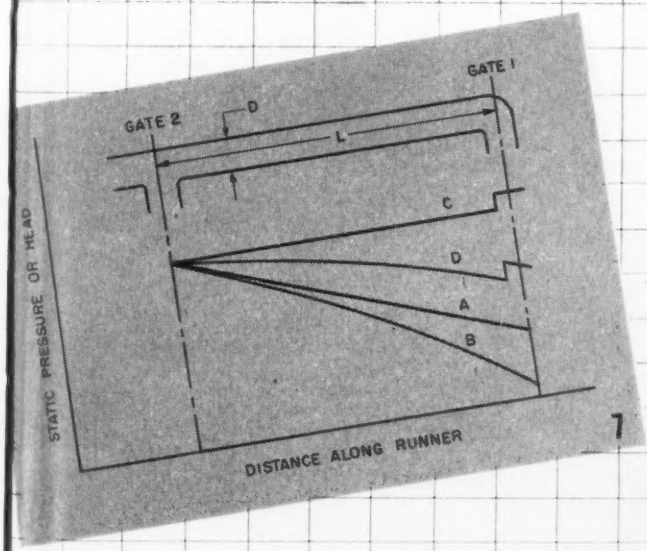
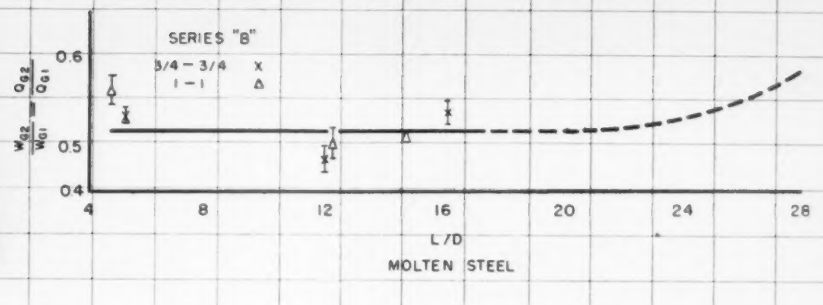
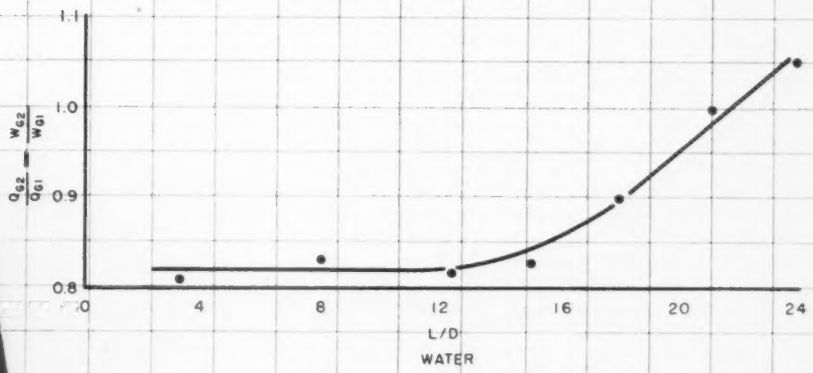


Fig. 7—Plot of static pressure vs distance flowed along runner. *A:* For water, showing effect of friction. *B:* For liquid steel, showing effect of friction. *C:* As predicted by Bernoulli's equation, without friction. *D:* As predicted for liquid steel by Bernoulli's equation with friction





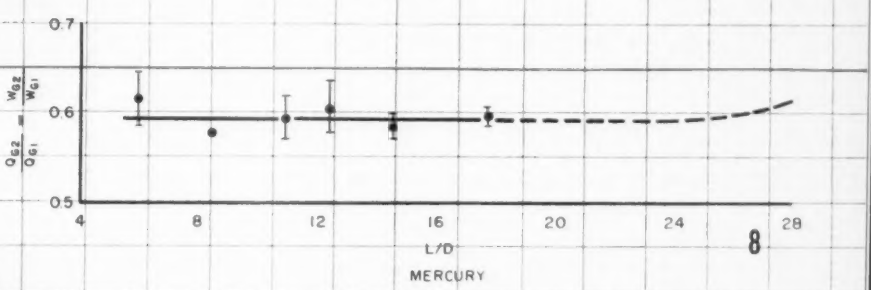


Fig. 8—Effect of length of runner between gates on the discharge ratio from a doubly-gated runner, length expressed as L/D

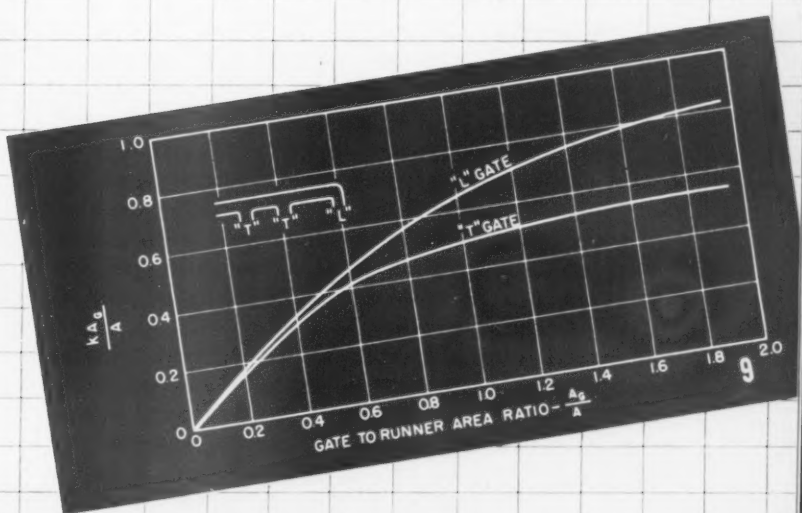


Fig. 9—Variation of discharge coefficient with gate-to-runner area ratio

Design of Gates

once known, it is a constant for a particular orifice.

Doubly-Gated Runners—We now have the background material necessary to find out how liquid metal will flow from a runner with two gates. Such a system is shown schematically in Figure 5. For simplicity, this is a runner with a constant diameter, and with a cross-sectional area *A*. The two gates, numbered as in the figure, have cross-sectional areas A_{G1} and A_{G2}. We will try to show how the equations we have mentioned can be used to predict the ratio of the flows from the two gates, and how this flow ratio will depend only on the geometry of the runner and gates.

First, we will write the equations for the volume rate of discharge, *Q*, from the two gates. These are given by Eq. 5.

$$Q_{G1} = k_1 A_{G1}\sqrt{2gh_1}$$
$$Q_{G2} = k_2 A_{G2}\sqrt{2gh_2}$$

We can also make use of Bernoulli's Equation between station 2 and station 1.

Station 2		Station 1
$h_2 + V_1^2/2_g$	=	$h_1 + 0$

And we can also make use of the continuity equation (Eq. 1) between the runner and gate No. 1: $V_1 A = Q_{G1}$

If we solve these four equations simultaneously, first eliminating V_1 and then h_2, and finally h_1, we obtain:

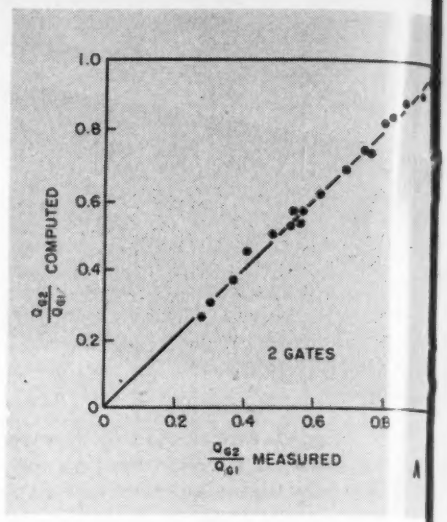
$$\frac{Q_{G2}}{Q_{G1}} = \frac{k_2 A_{G2}}{k_1 A_{G1}}\sqrt{1 - \left(\frac{k_1 A_{G1}}{A}\right)^2}$$

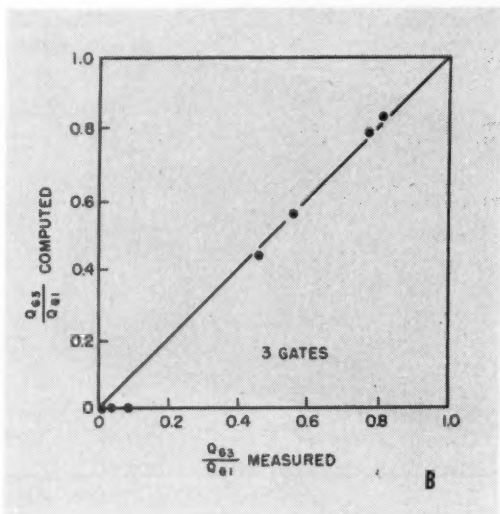
This can also be written (by dividing both numerator and denominator of the right side by A):

$$\frac{Q_{G2}}{Q_{G1}} = \frac{\dfrac{k_2 A_{G2}}{A}}{\dfrac{k_1 A_{G1}}{A}}\sqrt{1 - \left(\frac{k_1 A_{G1}}{A}\right)^2} \quad \text{..... (Eq. 6)}$$

This is the equation we have been looking for, and two interesting conclusions can immediately be drawn from it. First, the ratio of flow rates from the two gates, Q_{G1}/Q_{G2}, depends on the two *dimensionless ratios*, $k_1 A_{G1}/A$, and $k_2 A_{G2}/A$. That is, the flow ratio depends upon the gate-to-runner area ratios, and the two discharge coefficients k_1 and k_2. As will be shown later, the discharge coefficient also depends only on the gate-to-runner area ratios. It is important to understand that the flow ratio does not depend upon the absolute size of the gates and runner, but only on the area *ratios*.

A second point of interest is the fact that the distance between the two gates does not appear at all in the equation. In other words, the flow ratio is apparently independent of the distance between the gates, or the length of the runner between the gates.





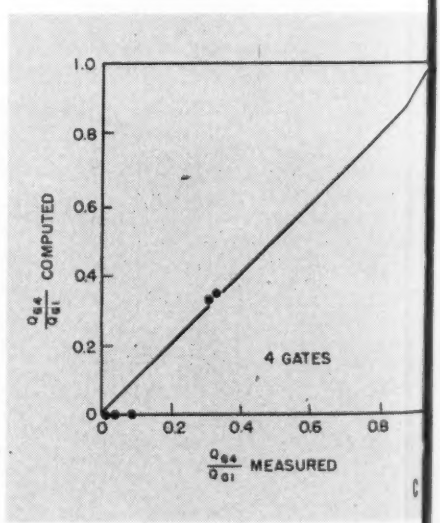


Fig. 10—Comparison of experimental and computed discharge ratios. *A*: Two gates. *B*: Three gates. *C*: Four gates

Fig. 11 — Rectangular plate casting used for hypothetical design problem

More will be said on this subject later.

We have yet to find numerical values for k. As was pointed out earlier, these numerical values have to be measured empirically; such values will be reported later in the section on "Experimental Results."

Three and Four-Gated Runners—Using the continuity equation, Bernoulli's equation and the orifice equation, as was done for two gates, it is possible to get similar resultant equations for the ratio of flow rates from the gates of three and four-gated runners. These equations are tabulated in Table I.

Similar comments can be made about the flow ratios for the third and fourth gates as were made about the second gate.

One additional fact is to be learned about the flows from the third and fourth gates. The equations actually predict when *zero* flow will occur through these gates, and when reversed flow-back into the gates will occur.

This may be better seen from the following explanation. If we concentrate our attention, for the moment, on the equation for Q_{G3}/Q_{G1}, we see that it is possible for this ratio to equal zero. This happens when the expression under the large radical sign on the right equals zero. That is:

$$\frac{Q_{G3}}{Q_{G1}} = 0 \text{ when}$$

$$1 - \left[\frac{k_1 A_{G1}}{A} + \frac{k_2 A_{G2}}{A} \sqrt{1 - \left(\frac{k_1 A_{G1}}{A} \right)^2} \right]^2 = 0$$

$$\text{or when } \frac{k_1 A_{G1}}{A} + \frac{k_2 A_{G2}}{A} \sqrt{1 - \left(\frac{k_1 A_{G1}}{A} \right)^2} = 1$$

Similarly, for the number four gate.

$$\frac{Q_{G4}}{Q_{G1}} = 0 \text{ when } \alpha + \frac{k_3 A_{G3}}{A} \sqrt{1 - \alpha^2} = 1$$

$$\text{where } \alpha = \frac{k_1 A_{G1}}{A} + \frac{k_2 A_{G2}}{A} \sqrt{1 - \left(\frac{k_1 A_{G1}}{A} \right)^2}$$

In other words, the flow through gate 3 will be zero if a certain expression equals 1. Similarly, the flow through gate 4 will be zero if a similar expression equals 1. If these expressions are *greater* than 1, then the flow will be reversed, *back into the gate.*

It should be noted that the expressions which determine when flow ceases through a given gate (or when reversed flow occurs) do not contain any reference to the size of that particular gate. This means that when reversed flow through a specific gate occurs, it is not possible to remedy the situation by merely increasing the size of that gate. It is necessary to decrease the A_G/A ratios of the gates *downstream* of it. This may be done either by decreasing the actual sizes of the gates downstream of the affected gate, or by increasing the runner diameter.

We are still, however, unable to make any numerical computations, because we do not know the numerical values of kA_G/A. These are given later.

Experimental Equipment and Technique—The experimental equipment used to check the theory and measure the discharge coefficients is essentially very simple. It is shown schematically in Fig. 6. The system consists of a runner with two or more gates, molded in dry sand. The (*Please turn to page* 237)

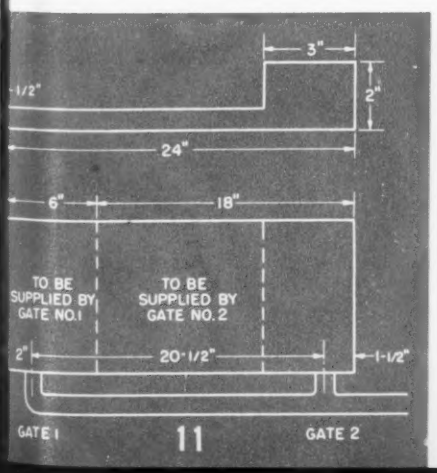
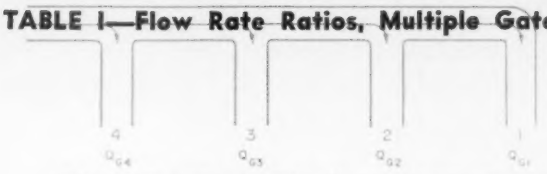


TABLE I—Flow Rate Ratios, Multiple Gates



Gate — Ratio of Flow Through This Gate to That from Gate No. 1

Gate No. 2

$$\frac{Q_{G2}}{Q_{G1}} = \frac{k_2 A_{G2}/A}{k_1 A_{G1}/A} \sqrt{1 - \left(\frac{k_1 A_{G1}}{A} \right)^2}$$

Gate No. 3

$$\frac{Q_{G3}}{Q_{G1}} = \frac{k_3 A_{G3}/A}{k_1 A_{G1}/A} \sqrt{1 - \left[\frac{k_1 A_{G1}}{A} + \frac{k_2 A_{G2}}{A} \sqrt{1 - \left(\frac{k_1 A_{G1}}{A} \right)^2} \right]^2}$$

Gate No. 4

$$\frac{Q_{G4}}{Q_{G1}} = \frac{k_4 A_{G4}/A}{k_1 A_{G1}/A} \sqrt{1 - \left[\alpha + \frac{k_3 A_{G3}}{A} \sqrt{1 - \alpha^2} \right]^2}$$

$$\text{where } \alpha = \frac{k_1 A_{G1}}{A} + \frac{k_2 A_{G2}}{A} \sqrt{1 - \left(\frac{k_1 A_{G1}}{A} \right)^2}$$

TABLE II—Effect of Absolute Size on Discharge Ratio From a Doubly-Gated Runner

Runner Diam., ins.	Gate Diam., ins.	$\frac{A_G}{A}$	Discharge Ratio Q_{G2}/Q_{G1}
¾	¾	1	0.53±0.2
1	1	1	0.52±0.2
1.4	1.4	1	0.53±0.3

TABLE III—Comparison of Measured and Computed Values of Flow Ratios for Two, Three, and Four Gated Runners

	Gate-to-Runner Area Ratios				Flow Ratios—Computed			Flow Ratios—Measured		
	A_{G1}	A_{G2}	A_{G3}	A_{G4}	Q_{G2}	Q_{G3}	Q_{G4}	Q_{G2}	Q_{G3}	Q_{G4}
	A	A	A	A	Q_{G1}	Q_{G1}	Q_{G1}	Q_{G1}	Q_{G1}	Q_{G1}
A.	0.29	0.29	0.29	...	0.910	0.826	....	0.930	0.809	....
B.	0.51	0.29	0.29	0.29	0.509	0.435	0.330	0.490	0.447	0.332
C.	0.51	0.51	...	...	0.836	....	....	0.830	....	....
D.	0.56	0.56	0.56	0.56	0.812	0.555	0.337	0.810	0.558	0.341
E.	0.56	0.66	0.88	...	0.880	0.789	....	0.865	0.780	....
F.	0.56	0.88	...	...	0.954	....	....	0.975	....	....
G.	0.66	0.56	...	...	0.690	....	....	0.690	....	....
H.	0.66	0.66	...	...	0.743	....	....	0.760	....	....
I.	0.88	0.56	...	...	0.530	....	....	0.530	....	....
J.	0.88	0.66	...	...	0.574	....	....	0.575	....	....
K.	0.88	0.88	...	...	0.621	....	....	0.620	....	....
L.	0.88	1.96	...	...	0.745	....	....	0.745	....	....
M.	1.0	1.0	...	...	0.570	....	....	0.520	....	....
N.	1.96	0.56	...	...	0.269	....	....	0.280	....	....
O.	1.96	0.88	...	...	0.314	....	....	0.318	....	....
P.	1.96	1.96	...	...	0.375	....	....	0.375	....	....
Q.	1	1	1	1	0.570	....	....	0.538	0.021	0.102
R.	1.56	1.56	1.56	1.56	0.429	....	....	0.410	0.081	0.043
S.	1	1	1.56	1.56	0.570	....	....	0.538	0.042	0.022

EFFECT OF TIME AND TEMPERATURE ON

Strength of Baked Cores

By CHARLES E. FAUSEL
Foundry Laboratory, University of Illinois
Chicago

MODERN foundries demand fast baking cores of good strength. However, since coreroom equipment and practice are not uniform among all foundries, core oil manufacturers have developed a number of types of oils varying in price and in ability to fulfill certain requirements.

In some foundries it has been possible to increase core production without addition of equipment by using faster baking oils. In other foundries it has been possible to slow the oxidation of an oil as it reaches its maximum binding strength. In the latter cases cores of various sizes were being placed in the oven simultaneously and were passing through the same baking cycle. Under such conditions the use of an improperly balanced oil would result in the large cores being underbaked when the small cores are at maximum strength, or the large cores would be at maximum strength and the small cores overbaked. If the oil is balanced, the baking strength curve will be flattened out at its maximum strength for a greater period of time; this means good strength for both large and small cores in the same oven during the same baking cycle.

The primary reason for baking cores, of course, is that in such condition they are stronger and harder than in the green state and can be handled more easily. The dry sand core is also more permeable than a green sand core. It was noted in the tests to be described that permeability was not affected by the baking temperature.

The rate at which a core bakes depends on many factors, such as time, temperature, binder, moisture, fineness of sand, size of core, type of core oven, and humidity. Each of these items is a variable and must be treated as such.

In discussing core baking, it is well to understand the manner in which heat acts on the core. When the core is placed in the oven, the first action of the heat is to drive off the moisture. Next, if an oil is used, the highly volatile fractions of the core oil are distilled off from the mixture. Finally, the actual baking of the binder, which causes the sand grains to adhere to each other, takes place. Baking a core oil comprises a series of complicated reactions involving the addition of oxygen and rearrangement of the molecules to provide the proper bond. In the baking process, the various reactions—evaporation, oxidation, polymerization and decomposition—may proceed in systematic order or, as is usually the case, overlap each other. To understand the process of oxidation which core oils undergo when they are baked, it is necessary to know something about the substances of which they are composed. Linseed oil is known to contain certain glycerides of oleic, linoleic, and linoleric acids. It is also known that oleic acid is singly unsaturated—that is, it can pick up or unite with one molecule of an element or compound. Linoleic acid is double unsaturated and can unite with two molecules; and linoleric acid is trebly unsaturated and can unite with three molecules.

Baking core oils, such as linseed, is primarily an oxidizing process. This means that oxygen is taken up by the unsaturated fatty acids in accordance with their degree of unsaturation. By doing so, the fatty acids become saturated and form larger and more complicated molecules which, in turn, are rearranged later through polymerization to form hard films which hold the sand grains together. Thus the hardening ability of core oils containing vegetable drying oils as bases depends to a certain extent on the degree of unsaturation of the fatty acids of which the oils are composed, which, in turn, is related to their ability to unite with oxygen.

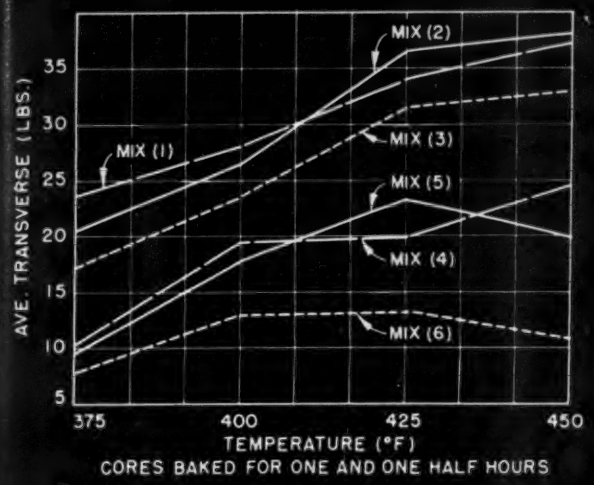
It may be stated that the vegetable drying oils, such as linseed, unite with oxygen at normal temperature, but the rate at which the oxygen is taken up, and hence hardened, is relatively slow. By application of heat, the rapidity with which oxygen is taken up is increased and the polymerization can begin sooner, thus forming the required solid film more rapidly. The ultimate strength of a core is totally dependent on the strength and elasticity of the film formed in the baking. This is largely a matter of proper time and temperature.

It should be pointed out that, as with any chemical reaction, there is a definite (*Please turn to page* 234)

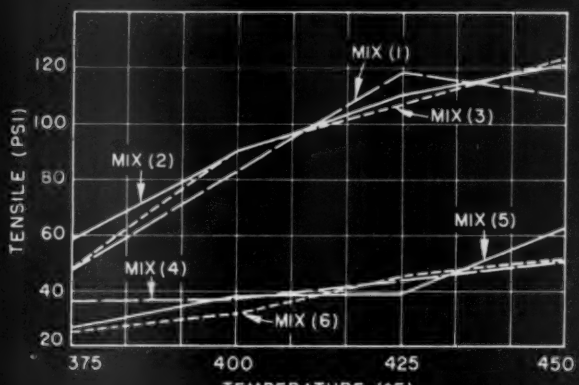
TABLE I—Core Sand Mixtures Tested

Mixture No.	Cereal, oz	Water, oz	Sand, lb	Oil, oz	Wood Flour, %
1	1	6	15	3	..
2	1	6	15	2½	..
3	1	6	15	2	..
4	1	6	15	3	1
5	1	6	15	2½	1
6	1	6	15	2	1

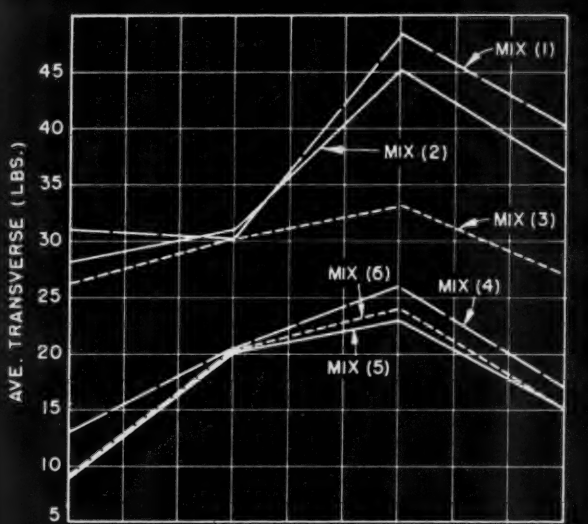
Mulling Time: Mull sand, cereal and wood flour for one minute. Add oil; mull three minutes. Add water; mull two minutes.



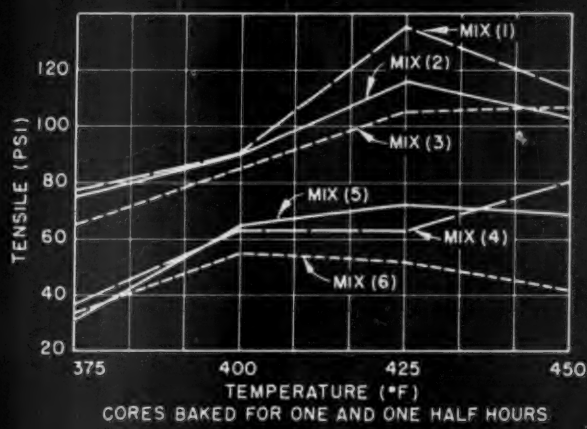
CORES BAKED FOR ONE AND ONE HALF HOURS



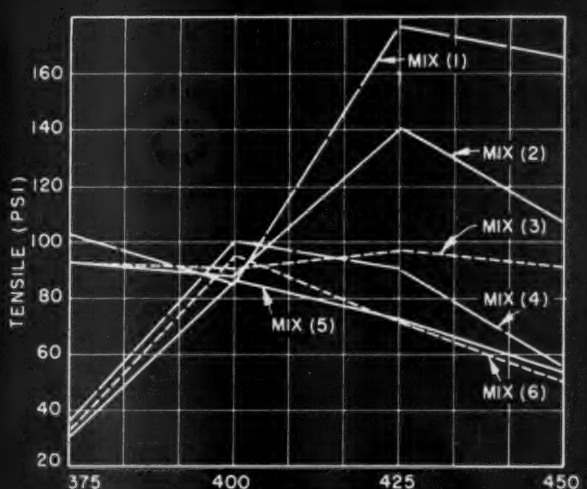
CORES BAKED FOR ONE HOUR



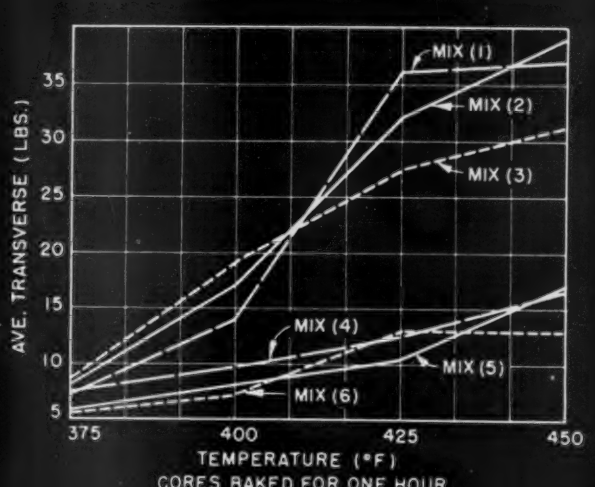
CORES BAKED FOR TWO HOURS



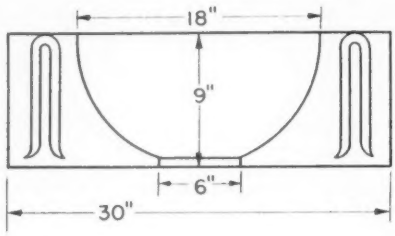
CORES BAKED FOR ONE AND ONE HALF HOURS



CORES BAKED FOR TWO HOURS



CORES BAKED FOR ONE HOUR



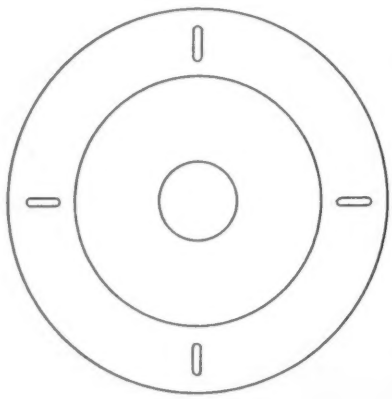


Fig. 1 — Plan and section

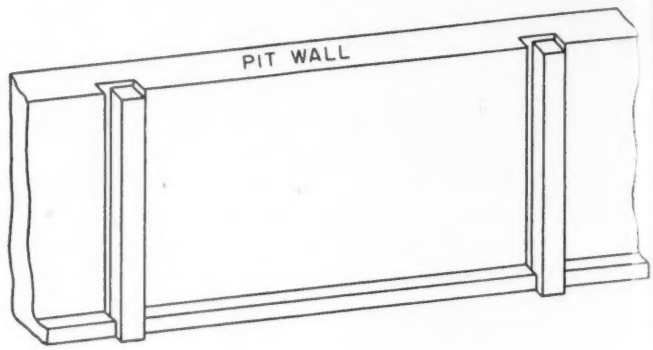


Fig. 2—Side wall and end cores for a casting molded in the vertical position

How to CAST A HEAVY TABLE

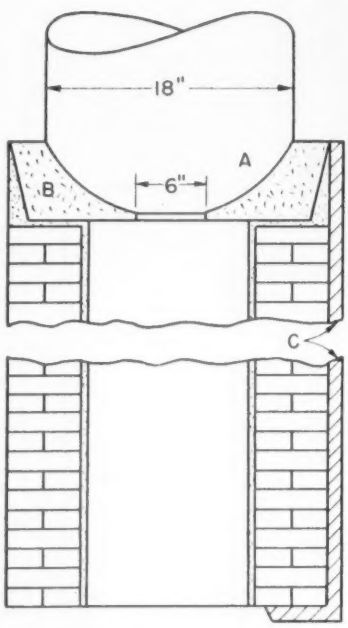


Fig. 3—Section of the closed vertical mold

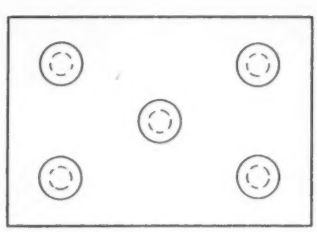


Fig. 4 — Five risers of type shown in Fig. 1 on cope face

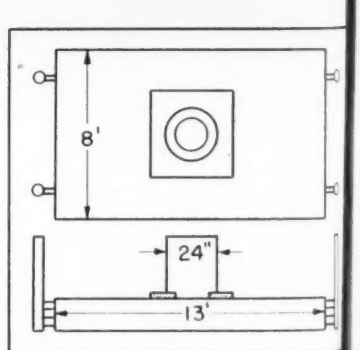


Fig. 5—Gates and center riser on flat mold

By PAT DWYER
Engineering Editor
FOUNDRY

WITHOUT actual precedence for a guide, the foundryman in some instances finds it difficult to decide on the best method to adopt in making a casting. This is particularly true when the casting is larger than those to which he is accustomed. The problem has many ramifications, including type of mold, position in mold, number and size of gates and risers, probable shrinkage and contraction, tendency toward warpage, metal composition, temperature and velocity of stream or streams of metal entering the mold, furnace and ladle capacity, number and capacity of cranes and several others that are bound to arise before and during the period the project is in hand.

A typical instance of this kind confronted a foundryman who had accepted an order to supply two hydraulic press tables—solid cast iron slabs, one 8 x 13 ft, 15 in. thick; the other 7 x 10 ft, 12 in. thick. Each casting had to be clean, solid and homogeneous, since a great number of 2-in. holes had to be drilled from top to bottom on 6-in. centers, and a number of *T* slots were to be machined across one face.

A cupola mixture of selected pig iron, cast iron scrap and 35 per cent steel scrap would yield iron of the following approximate composition: Total carbon 3.00-3.25 per cent, silicon 1.00 per cent, sulphur 0.10 per cent, manganese 0.80 per cent, phosphorus 0.30-0.40 per cent. Alloy additions —3.00 per cent nickel and 1.00 per cent chromium—would improve the tensile strength.

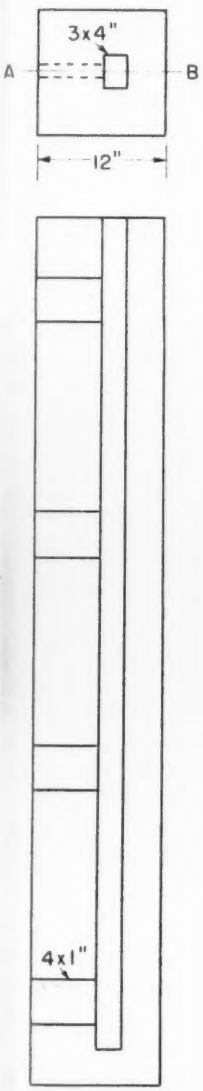
Ample Gating System Needed To Fill Mold in Minimum Time

The mold should be filled rapidly to minimize the time the cope face is exposed to the intense heat from the rising metal. Therefore it is necessary to make the mold in position where it may be served by two cranes and two ladles, one at each end. The metal would be poured from each ladle into a long basin across the top of the cope. From each basin the metal will enter two 3 in. diam sprues about 5 ft apart. From each sprue the metal will flow into the mold through two 2 x 5 in. rectangular gates, one near the bottom and the other near the top of the mold. Instead of forming the gates in sand it may be advisable to form the entire sprue and gate passages in refractory tiles. The gate openings may be circular or rectangular. That is a feature of minor importance. The casting may be fed from a central riser 24 in. diam 30 in. high, constricted at the neck to 18 in. by a flat, thin dry sand core. A sketch of gates and riser is shown in Fig. 5.

Under normal conditions the casting will shrink at the rate of ⅛-in. per foot—in this instance approximately 1½ in. in length, 1 in. in width and 3/16 in. in thickness. Unless the mold is unusually strong and rigid, it will yield to some extent and the casting will be larger than anticipated. Unless rigid specifications insist on a solid casting, the design might be changed to a box type of construction, either plated top and bottom or plated on the top and open at the bottom with the exception of longitudinal and transverse strengthening ribs. This type of casting would weigh less, be just as strong, and would not need a heavy feeding riser. The face in which the T-slots are to be machined should be on the bottom of the mold.

The flat core which forms the neck of the riser and shown in Figs. 1 and 3 is made in the ordinary manner from a strong grade of sand bonded with either a liquid or a dry binder. It may be reinforced with a cast iron arbor or with a number of loose rods. Materials and methods are of relatively minor importance. The core shown in Fig. 1 is placed on the pattern, rammed up with the cope and wired through the steel loops to the bars in the cope.

Whether to use one central riser or a number of risers spaced strategically is open to debate. General foundry experience inclines one to favor a total of five risers, somewhat smaller than the single central riser shown in Fig. 5. On the other hand, it is comparatively common knowledge that large anvil bases weighing more than 100 tons are fed from a single central riser. If the foundryman does not favor a single riser in the center of the press table casting, he may use five risers, one in the center and the other four spaced equidistantly (*Please turn to page* 211)



SECTION AT A-B

Fig. 6 — Gates in end cores of Fig. 2

QUESTIONS and

Crucible Sticks to Pedestal

Q.—How can we prevent a crucible from adhering to the stool in a furnace? What is the best material for a stool or pedestal? We are using coke-fired furnaces, but we understand that stools also are used under crucibles in oil-fired furnaces. We would like to use stools, but we have been unable to find any material that will not burn onto the crucible bottom.

A.—The stool burns onto the crucible because the coke burns away from around the stool. In an oil-fired furnace the temperature around the stool is sufficiently high to prevent freezing. Consequently, if a certain amount of slag accumulates between the stool and the bottom of the pot, it does not congeal and therefore permits removal of the crucible from the stool. The stool should be of the same composition as a good fire brick, the same diameter as the bottom of the pot. Otherwise it will cause the pot to crack or break.

Stools also are made of the same material as crucibles and may be purchased from the crucible makers whose names and addresses appear regularly in the advertising sections of FOUNDRY. To prevent a stool from adhering to the bottom of the pot, the coke should be poked down around the side of the stool to keep the pot bottom hot. A layer of fine coke placed on the stool also will prevent adhesion between stool and pot.

At the recent AFS convention in Cleveland, a speaker at one of the nonferrous sessions claimed that a little silicon carbide or silica sand sprinkled on the top of the pedestal will prevent the crucible from sticking. This statement was amplified by a member on the floor who claimed that nothing equals a handful of charcoal for this purpose.

Casting Has Defects on Sides

Q.—For your examination we are forwarding a section of an aluminum casting, a circular dished plate 18½ in. diam, ¼ in. thickness of metal, with an ornamental border. The casting is perfect in all respects with the exception of many small irregular markings on the cope and drag sides. The mold is made in No. 00 Albany sand and the metal mixture contains two parts of scrap, and one part of well known ingot metal. The metal is poured at approximately 1300°F. We shall appreciate your advice on the proper procedure to eliminate the foregoing form of defect.

A.—The wavy indented lines on the casting are caused by a light oxide film on the surface of the molten metal. The defect is not exactly a cold shut, but it is closely related. The film, in narrow streaks, travels with the metal most of the way, but if the uniform and rapid movement halts for even a fraction of a second, the streaky film remains in contact with the sand. The obvious remedy is to prevent the formation of an oxide film, and if a film develops during the melting period, to prevent it from entering the mold with the metal. Where many metal compositions are melted it is easy to contaminate any given mixture, either by addition of foundry scrap or by using dirty equipment.

Necessity for proper care of melting pots, ladles and other equipment should be emphasized. Pots should be cleaned thoroughly and coated to prevent iron pickup. Agitation of the metal either in the furnace or in the ladle increases oxide formation. When transferring from furnace to ladle, or from ladle to ladle, the metal should be poured steadily and the stream should be as short as possible.

Presence of sand grains here and there in the casting seem to indicate that the molder was not as careful as he should be in preparing the sprue and gates. The mold should be filled rapidly from a ring of gates fed by two sprues and two ladles. The broken edge of the piece submitted for examination shows that your metal composition and melting practice are satisfactory. All of which may be summed up in a single sentence: Keep the metal clean and pour it fast and hot.

Melt Shot Iron in the Cupola

Q.—We shall appreciate your opinion on the feasibility of melting shot iron in the cupola. We have plenty of stove plate scrap and we are inclined to the opinion that if the stove plate scrap is charged first it will prevent the shot iron from falling through. The metal is to be poured into sash weight castings. What is the proper weight of iron, coke and limestone for charging a cupola 42 in. inside the lining. Is there any difference between the weight or volume of beehive coke and by-product coke in the charge? Does one require a stronger blast than the other?

A.—Some foundrymen hold an unjustified prejudice against the use of shot iron and other small scrap from the cupola drop. It is just as good as any other iron. The theory that shot iron works its way through the charge and is carried through the tap hole into the ladle and thence into the mold will not bear close investigation. It might happen, but it is highly improbable. Small hard lumps occasionally found in castings are due to entirely different causes, not necessary to discuss at present. The fact that nodules of this kind sometimes are found in castings poured from excellent pig iron and carefully selected scrap entirely disproves the shot iron theory.

You safely may use stove plate scrap and shot iron in practically any combination. For long heats and exceedingly hot iron, the iron charge should not exceed 1000 lb. For comparatively short heats and

Answers

where exceedingly hot iron is not a major requisite the charge may be 3000 lb iron with 325 to 350 lb coke and 60 lb limestone between charges. All coke and all limestone are not alike. The relative proportions of iron, coke and limestone can be adjusted to local conditions after a few experimental heats.

Height of the coke bed will depend on the height of the tuyeres above the sand bottom. After the initial bed extending about 12 in. above the tuyeres has burned through, additional coke is added to a height of 30 to 36 in. above the tuyeres. When this has burned through, another 6 in. is added and then iron, coke and limestone in successive layers are charged until the cupola is filled to the charging door. In some foundries it is considered good practice to allow the cupola contents to soak for an hour or more before starting the blower. In other foundries the blower is started as soon as or shortly after the cupola is filled to the charging door.

There is no appreciable difference between beehive and by-product coke as used in the cupola. Melting capacity of a 42 in. diam cupola is approximately 7 tons per hour with a blower capable of delivering 3000 cfm at a pressure of 10 to 12 oz.

Make Rolls in Sand or Chills

Q.—We shall appreciate a brief description of the methods, technique and equipment employed in the production of cast iron rolls.

A.—Iron rolls are divided into two general classes: those cast in sand molds and those cast in chill molds. Rolls cast in sand, and this term always means dry sand, are known as grain rolls. The grain of the metal is conspicuous when the face of the roll is machined. Plain small rolls are molded from a full pattern with necks and wabblers. Large rolls are molded by sweeps cut out to conform to the desired shape. After the half molds are dried they are assembled, up ended and lowered into a pit in the floor.

In some instances the metal is tapped directly from the furnace into the mold. For certain types of rolls cupola melted metal is satisfactory, but the air furnace is the usual melting medium. This type of furnace permits the use of large pieces of scrap, including scrap rolls. The operator has the opportunity of taking samples from the bath, pouring the metal in test molds, breaking the test bars before actually tapping the furnace. To an experienced eye, the fractured test indicates the depth of chill. Composition of the metal is checked by laboratory analysis.

Chilled rolls are cast in iron molds which chill the metal to a definite and predetermined depth on the working face of the roll. The body or barrel of the mold is made up of one or more chill sections. Necks and wabblers are made in dry sand molds. A roll mold always is poured through a spinning gate set at a tangent to the lower neck. This ensures that any foreign material entering with the metal will remain in the center of the rising and whirling column of metal and eventually will come to rest in the sink head.

The runner erected on the outside of the chill is made up of two or more small boxes. The lower flange of the first box is clamped to the flask containing the lower roll neck. A flaring pouring basin, lined with dry sand or loam, is attached to the top of the runner box. The molten metal is poured very rapidly into the pouring basin. Pouring speed exercises a definite influence on the character of the casting. Pouring temperature also is important.

Truck Wheels Crack in Molds

Q.—A large number of our small cast iron truck wheel castings crack before they are shaken out of the molds. Cupola charge is made up of 50 per cent mixed machinery and stove plate scrap, and 50 per cent soft pig iron. The wheels are poured in cast iron chills and allowed to cool in the molds.

A.—You do not give the analysis of the iron in the castings, but an opinion based on the reference to the components indicates that the silicon content is too high, and possibly other elements are out of line for this type casting. A suitable 50-50 mixture of pig iron and scrap should yield a composi-

GANGWAY!

By J. A. PATTERSON

"Oh, I love that—Johann Strauss, isn't it?"

tion showing Si 0.75 per cent, S between 0.07 and 0.14 per cent, Mn 0.60 per cent, and P not over 0.30 per cent. Broken car wheels constitute the most desirable form of scrap. The pig iron should show an analysis that will blend with that of the scrap to yield the desired composition.

One of the most essential features in the production of chilled cast iron wheels is annealing. As soon as possible after the metal has solidified in the molds, the castings are shaken out and immediately placed in soaking pits where they cool slowly and thus prevent intense strain and cracking.

Vent Drag To Prevent Defect

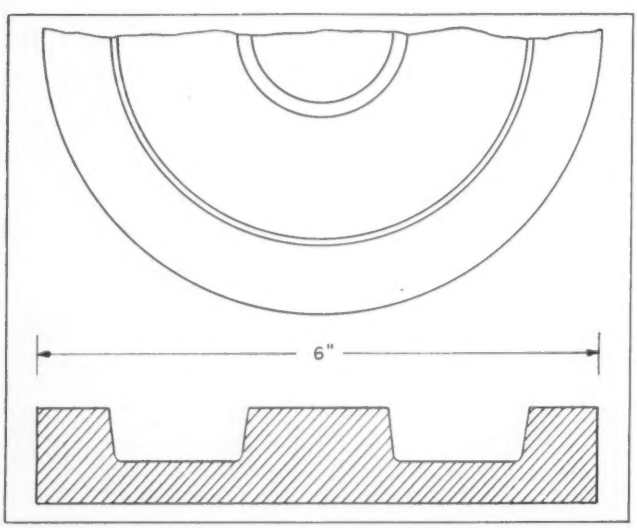
Q.—Since moving into a new location quite a number of our castings are showing defects similar to one we are forwarding for your inspection. We shall appreciate an expression of opinion on the cause of the defective cope area.

A.—The pock-marked cope face of the casting submitted for inspection was caused by steam that did not escape rapidly enough downward from the mound of sand in the drag side of the mold. Some of this steam penetrated the molten metal and formed bubbles that eventually came to rest against the sand face of the cope. To use the usual foundry term, the iron was kicking or boiling instead of remaining quiet in the mold.

The kicking or boiling action may be traced to wet sand, highly bonded sand, or sand that is rammed too hard. If the castings made in your former location were satisfactory, and if the castings made in the new location are similar to the sample casting, the probability is that you have added a quantity of new sand to your sand heaps, and that this new sand is much tighter—that is, higher in clay content than the old

Sand containing excess moisture will produce an excessive amount of steam. The condition is accentuated where the sand permeability is low. The third factor, hard ramming, may be responsible for your trouble. When the sand permeability is high it may be rammed much harder than when the permeability is low. The boiling or kicking action may be caused by any one of the foregoing factors, or by any combination of three factors.

The proper remedy will depend on the cause of the defect. If the permeability, moisture content and ramming density are exonerated, the simplest remedy is to use perforated bottom boards, or vent the drag of the mold with a wire, or both. By pouring one of the molds open—without a cope—you can note whether or not the metal lies quietly on the sand mound in the drag.



Where the sand in the circular mound is not sufficiently permeable, it should be vented with a wire

Assembled in Stack Position

Q.—We shall appreciate information on how to utilize our present floor space to better advantage. At one time or another we have seen illustrations in FOUNDRY showing small molds stacked on top of each other. We have no clear impression of the manner in which these molds are poured. Apparently the problem has been solved satisfactorily. We should like to adopt the system.

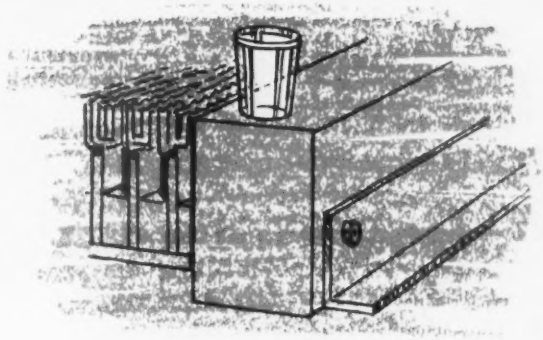
A.—Briefly the method may be divided into two general classes. The first is confined to molds in which part of the mold cavity is in the cope, or where there is an irregular parting, also where the sprue is located close to one side or to one end of the flask. In a case of this kind, the lowest mold in the stack is poured first. In erecting the stack, the second and succeeding molds are not placed directly on top of each other with all four corners coinciding. Each of the upper molds in the stack is kept back a sufficient distance to expose the sprue opening in the mold immediately beneath. The lowest mold in the stack is poured first to prevent any metal splash from falling into any of the other sprue openings.

The second method is confined to molds with flat face copes. The molds may be stacked from five to ten or more high. Properly speaking no cope is employed in this method. The bottom face of each mold section serves as a cope for the mold immediately beneath. A continuous sprue extends from the top to the bottom of the stack. The bottom drag rests on a board or plate. In this section the sprue opening is plugged, usually with a short length of dry sand stock core. Usually the method is confined to an arrangement of patterns which permits the sprue to be placed in the center of the mold. The molds may be made in a snap flask, or in shallow one-piece tight flasks. In the snap flask mold a shallow steel band, which fits closely inside the flask, is rammed up with the mold. The band is designed to reinforce the sand after the snap flask is removed. Slip jackets sometimes are used for the same purpose, but unless they fit tightly they are not as reliable as the band rammed up inside the flask.

All SHAKE-OUTS are NOT alike

The Royer Shake-Out employs an entirely new and different principle of operation. A rigidly connected series of grids ride on eight motor driven eccentrics, one at each corner of the shake-out grids. These eccentrics move the grids rapidly up and down alternately. This rapid, reciprocating action completely loosens the sand in the molds . . . the sand drops between the widely spaced grids and the walking beam action conveys the castings and flasks off the end of the shake-out to tote box or conveyor.

Used with a Royer Sand Separator and Blender and magnetic separator if desired, you will have a complete, compact sand conditioning unit; designed for fast, positive operation with long life and low maintenance cost. Sand is conveyed over the magnetic separator where fine scrap is removed, tempered as it enters the hopper of the Sand Separator and Blender and discharged completely conditioned and ready for the molders' use. Investigate the possibilities of such a unit in your foundry. Write us today.



Minimum Vibration

A Royer cannot shake itself apart. There is so little vibration imparted that a full glass of water on the frame will not spill a drop while the shake-out is in operation. No self-destructive, twisting or wrenching motions . . . frame is always stationary . . . only the grids move.

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FOREMOST IN SAND CONDITIONING EQUIPMENT

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By EDWIN BREMER

Foundry DEVELOPMENTS

CONCLUSIONS drawn by Ruddle and Mincher in a study of "The Influence of Alloy Constitution on the Mode of Solidification of Sand Castings," as reported in the November, 1950 issue of the *Journal,* Institute of Metals (London) include the following: (1) The pure metals copper, aluminum, magnesium and zinc solidify by skin formation. Approximate equations for the rates of skin formation of these materials under conditions of unidirectional solidification have been determined experimentally. In practice the rates of skin formation in sand castings are likely to be much higher, except near the centers of large flat castings. (2) Alloys with long freezing ranges solidify in the "pasty" manner described in an earlier paper. The present work suggests that nearly all sand-cast solid-solution alloys, even those of short freezing range, solidify in this way, especially when cast in heavy sections. (3) The mode of solidification of eutectic alloys remains obscure. In some cases skin formation or a near approach occurs; in others some form of pasty solidification seems to obtain.

* * *

NEWLY developed riser or hot-topping compound is reported to cut the poured height of hot-tops on steel ingots by 2 in., and reduce the metal by 1.5 per cent. Material also is said to give a desirable u-shape cavity in the hot-top rather than the objectionable v-shape. Compound weighs 48 lb per cu ft, and can be applied for 3 cents per ingot-ton.

* * *

INSULATING properties of vermiculite, a mineral of the mica family, are illustrated well by a recent report of transporting a 30,000-lb ingot at high temperature for a distance of 200 miles with a comparatively low loss in temperature. Ingot was stripped from the mold at 1770° F and imbedded in vermiculite in a cast iron box and shipped by railway to another plant for processing. On arrival at that plant the next morning, the temperature of the ingot was 1575° F. With such insulating property it looks as though the material would be a good thing to have around where it is desirable to cool a casting slowly. Shaken out of the mold while still at high temperature, the casting could be imbedded in vermiculite for any desired period of time.

* * *

AN ARTICLE in January FOUNDRY, "Effect of Oxygen Content on Iron Casting Properties," mentioned one proprietary silicon carbide available for deoxidizing molten iron in the cupola. Attention has been called by the Electro Refractories & Alloys Corp., 344 Delaware Ave., Buffalo 2, to the fact that it also now is offering metallurgically reactive silicon carbide processed solely for the same deoxidation purpose. It is marketed in the form of 5-lb briquets under the trade name Electro-Carb.

* * *

APPLICATION of ferroselenium as a final degasifying agent in the production of 18-8 stainless steel in the high-frequency electric furnace is practiced in one foundry. Amount added is ¼-lb per ton (0.0125 per cent Se), and it has been found to be a definite insurance against gas porosity of the reducing-gas type frequently experienced from high hydrogen or nitrogen contents. Extensive studies of the effect of minor Se content on physical and mechanical properties, welding characteristics, and resistance to corrosion indicate that no measurable effect exists with Se up to approximately 0.10 per cent.

* * *

CURRENT information on standards and pure materials for spectrochemical, analytical chemistry and allied fields is available in a recent publication of the American Society for Testing Materials, 1916 Race St., Philadelphia 3. Following an introduction describing the scope of the report with definitions and nomenclature, extensive tables and data are given on standard samples for iron and steel, aluminum and its alloys, magnesium and its alloys, zinc, lead and tin alloys, and copper alloys. Total number of entries of standards and pure substances is 1077, and names of organizations supplying the material are noted. Copies of the report (Technical Publication No. 58 B) may be obtained from the society for $1.25 each.

* * *

ONE LARGE producer of fuel oils, lubricants, core oil, etc., is making available to industry a service which answers the questions: Is fuel being wasted unburned; is energy being wasted in uselessly heating excess air, and has the maximum heat been extracted from the waste products? Service includes a trained engineer with an instrument for determining amount of unburned fuel, amount of oxygen, and temperature of exhaust gases. It is said that with the instrument it is a simple matter to explore in detail any part of a furnace, pit or crucible atmosphere, and that the unit gives an immediate response to any changing conditions of oxidation or reduction in the hot gases.

* * *

INVESTIGATION on aluminum-4 per cent copper-0.15 per cent titanium alloy by Hardy and reported in October, 1950 issue of *Journal,* Institute of Metals (London) indicates that small quantities (0.05 per cent) of cadmium, indium or tin have a definite influence on the course of precipitation of copper in aluminum. Natural aging is depressed, but the rate of artificial aging is accelerated by a factor between three and eight. Both the response to artificial aging and the absolute strength are increased.

* * *

EFFECTIVE use of oxygen injection to speed up carbon removal and shorten the time of the electric furnace steel heat is accomplished when the bath is at a high temperature, and the "boil" is imminent. In most instances that stage of operation is determined by observation, for example, by the bath showing a slight swelling or movement in the way of bubbling in front of the door and around the edges. However, one foundry determines that point from a recording ammeter connected into the primary circuit of the electric furnace. Point of "boil" is indicated on the ammeter by sudden surging in the flow of current into the bath, and oxygen injection then is begun.

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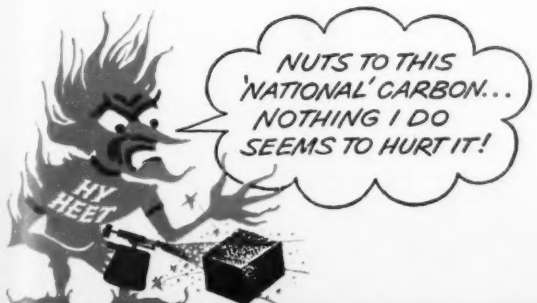
15 blast furnaces in the U.S. have each produced over 1,000,000 tons of iron on a single "National" carbon lining . . . and are still going strong!



BLAST FURNACE LININGS • BRICK • CINDER NOTCH LINERS • CINDER NOTCH PLUGS • SKIMMER BLOCKS • SPLASH PLATES • RUNOUT TROUGH LINERS • MOLD PLUGS • TANK HEATERS

MEN *of Industry*

HAROLD H. JUDSON has been appointed plant manager, Kencroft Malleable Co., Buffalo, where he will supervise foundry operations and act as assistant to the president. Mr. Judson, a graduate of Worcester Polytechnic Institute, was previously associated with Riley Stoker Co., Detroit, Goulds Pumps Inc., Seneca Falls, N. Y., Standard Foundry Co., Worcester, Mass., and more recently was foundry manager of the Lake Street plant of Minneapolis-Moline Power Implement Co., Minneapolis. He is a former chairman of the Central New York Chapter of the American Foundrymen's Society as well as one of the society's former national directors.

♦ ♦ ♦

Ray E. Kalmbach has been named general manager, Wilson Foundry & Machine Co., subsidiary of Willys-Overland Motors Inc., at Pontiac, Mich., succeeding **Maj. Gen. George D. Pence,** resigned. Mr. Kalmbach joined Ford Motor Co. in 1920 as a toolmaker. During World War II he was in charge of all Ford aluminum foundries until he retired in 1946. He became foundry consultant for General Electric Co. in 1948 and recently served as foundry superintendent at Nash-Kelvinator Corp., Kenosha, Wis.

♦ ♦ ♦

A. J. McDonald, who, as reported last month, has been appointed chief of the Iron and Steel Castings Section, Iron and Steel Division, National Production Authority, Washington, is vice president, American Steel Foundries, Chicago. He has been associated with that organization since 1939 when he resigned as vice president in charge of sales, Lebanon Steel Foundry, Lebanon, Pa., to accept a similar position with American Steel Castings Co., Newark, N. J., a subsidiary of American Steel Foundries. Four years later he was elected vice president of the latter and was transferred to the company's Chicago headquarters in charge of industrial steel casting and automotive division sales.

♦ ♦ ♦

Paul M. Arnall has been elected president, Lunkenheimer Co., Cincinnati, succeeding **Frank P. Rhame,** resigned, who has been president since 1945 and who will continue as a director and in an advisory-consulting capacity. Mr. Arnall, a graduate of University of Kansas, joined the company a year ago as vice president-general manager. He spent 18 years with Graton & Knight Co., Worcester, Mass., maker of leather belting and mechanical specialties. In 1938 he became general sales manager, Ohio Injector Co., Wadsworth, O., where he later served as vice president-sales, executive vice president and a director.

Robert F. Muhleman has been appointed assistant to the president, Cochrane Foundry Inc., York, Pa. Mr. Muhleman, a graduate of Ohio State University, has spent over 20 years in manufacture and sale of heating, air conditioning and refrigeration equipment. During World War II he served as industrial manager of shipyards in Bremerhaven, Germany, for the Navy.

♦ ♦ ♦

H. A. Forsberg, since 1948 a vice president of Continental Foundry & Machine Co., East Chicago, Ind., has been named a director. Associated with the company for over 35 years, he has served as superintendent of the East Chicago plant, manager of operations, and castings sales manager.

♦ ♦ ♦

Edward Salner has been named manager of the precipitator department, Metal Products Division, Kop-

(*Continued on page* 130)

HAROLD H. JUDSON
. . . Kencroft Malleable mgr.

RAY E. KALMBACH
. . . joins Wilson Foundry

A. J. McDONALD
. . . NPA castings chief

PAUL M. ARNALL
. . . Lunkenheimer president

Famous CORNELL CUPOLA FLUX

As important as this

● For years, leading gray iron foundries have endorsed it as a "must" to obtain clean metal for better castings and highest efficiency in cupola operation.

Malleable foundries, with cupola operation, say it reduces erosion and maintenance of brick or stone linings, and gives their castings a better start and reduces sulphur.

Easy as this to use

BETTER CASTINGS — MINIMUM REJECTS PROVE THE IMPORTANCE OF CLEAN IRON

Famous Cornell Cupola Flux has a record of more than thirty-three years of success in casting improvement. This has been achieved by—

- PURGING MOLTEN METAL OF IMPURITIES.
- INCREASING THE FLUIDITY OF IRON.
- GREATLY REDUCING SULPHUR.

When you use Famous Cornell Cupola Flux there is a notable absence of chilled sides, hollow centers and hard spots in castings, and machining is definitely easier and smoother.

Cupola operation is more efficient, too. Cupolas are kept cleaner, life of lining whether brick or stone, is greatly prolonged —maintenance is practically nil.

SCORED BRICK FORM practically eliminates the labor cost of fluxing molten iron.

No digging out of container, no weighing, no measuring. You simply lift Famous Cornell Cupola Flux out of container and toss it into cupola with each ton charge of iron or break off one to three briquettes (quarter sections) for smaller charges, as per instructions. *WRITE FOR BULLETIN NO. 46-B.*

Famous CORNELL ALUMINUM FLUX

CLEANSES MOLTEN ALUMINUM so that you pour clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections can be poured. Castings take a higher polish. Exclusive Formula greatly reduces obnoxious gases, improves working conditions. Dross contains no metal after this flux is used.

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FAMOUS CORNELL FLUXES
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Famous CORNELL BRASS FLUX

CLEANSES MOLTEN BRASS even when dirtiest brass turnings or sweepings are used. You pour clean, strong castings which withstand high pressure tests and take a beautiful finish. The use of this flux saves you considerable tin and other metals, and keeps crucible and furnace linings cleaner, adds to lining life and reduces maintenance.

MEN *of Industry*

(*Continued from page* 128)

pers Co., Pittsburgh, succeeding the late Frank H. Linthicum. Mr. Salner was graduated from Purdue University with a degree in industrial engineering. He joined Koppers as personnel manager in 1939, became assistant works manager in 1942, and in 1944 was transferred to the Tar Products Division as industrial relations manager. In 1945 he joined the State Department as labor attache in Vienna, returning to Koppers as sales engineer in the precipitator department in 1947.

♦ ♦ ♦

H. Bornstein, until recently manager of the materials engineering department, Deere & Co., Moline, Ill., has been appointed chief technical consultant, with headquarters in the general offices of the company, under C. N. Stone, vice president. Mr. Bornstein, who joined the company in 1920, has become well known in scientific and technological fields through his work with the materials engineering department. He will be engaged in planning and product development, functioning with a wide degree of independence. **F. T. McGuire** succeeds Mr. Bornstein as materials engineering department manager, reporting to L. A. Murphy, vice president. He has been with the company since 1949 and has been Mr. Bornstein's assistant since July of that year.

♦ ♦ ♦

Donald H. Workman, recently acting executive vice president, has been named executive vice president, Gray Iron Founders' Society, Cleveland. Mr. Workman was graduated from Wharton School, University of Pennsylvania, in 1938. Prior to his affiliation with GIFS three years ago, Mr. Workman was associated with the public relations department, Philadelphia Electric Co., Philadelphia. He served as administrative officer with the Navy during World War II and was released with the rank of lieutenant, senior grade.

♦ ♦ ♦

Ray H. Sullivan, since 1949 manager of Ford Motor Co.'s automotive manufacturing operations, has been appointed a company vice president to head the recently organized engine and pressed steel group which comprises the engine and foundry, metal stamping and parts and equipment manufacturing divisions. Engine and foundry division includes the motor plant and foundries at the Rouge and engine and foundry plants under construction in Cleveland. Mr. Sullivan joined Ford in 1948 as assistant general manager of Rouge's automotive manufacturing operations. Prior to that he was vice president in charge of manufacturing, E. W. Bliss Co., Toledo, O., and assistant general manager, U. S. Cartridge Co.'s St. Louis plant.

♦ ♦ ♦

Farnsworth Chapin has been appointed sales manager, Aquadyne Corp., New York, maker of wetting compounds for dust control, product cleaning and fire fighting installations. Mr. Chapin, a graduate of Cornell University, has been engaged in sales-management work in the plastics industry.

♦ ♦ ♦

Lorenzo Semple has been elected vice president-treasurer, and **John W. Brennan,** secretary, United States Pipe & Foundry Co., Burlington, N. J. Mr. Semple, a graduate of United States Naval Academy, joined American Water Works & Electric Co. in 1926. In 1948 he became vice president, American Water Works Co., and more recently has been consultant to financial interests in the Belgian Congo. Mr. Brennan will assume the duties of secretary, in addition to being company counsel, a position he has held for 5 years. **Donald Ross** has resigned as secretary-treasurer of U. S. Pipe to become vice president, United Concrete Pipe Corp., Baldwin Park, Calif., subsidiary of the former company.

♦ ♦ ♦

Arnold M. Lenz, recently appointed general manager of the Pontiac Motor Division, General Motors Corp., has also been named a vice president of GMC and a member of the administration committee. Mr. Lenz joined Buick Motor, Flint, Mich., in 1916. In 1919 he became superintendent of the gray iron foundry of the former Saginaw Products Co., Saginaw, Mich., which was taken over by Chevrolet in 1927. He was a manufacturing executive of Chevrolet for about 20 years and until his recent appointment was executive assistant to the general manager of Pontiac. Mr. Lenz was the J. H. Whiting gold medalist of the AFS in 1934.

♦ ♦ ♦

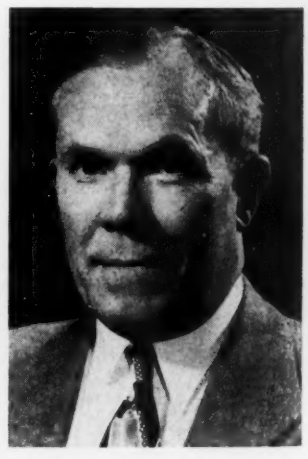
John W. Pennington, formerly staff engineer, Caterpillar Tractor Co., Peoria, Ill., has been named chief engineer of the Piston Ring Department, Koppers Co., Pittsburgh, responsible for design and metallurgy of the company's piston rings, shop and field testing, supervision of research activities and engineering customer contacts. Mr. Pennington was graduated from Kansas State College in 1939, when he joined Caterpillar Tractor Co. as a student en-

(*Continued on page* 132)

H. BORNSTEIN
. . . chief technical consultant

F. T. McGUIRE
. . . materials engineering mgr.

DONALD H. WORKMAN
. . . exec. vice pres., GIFS



RAY H. SULLIVAN
. . . vice pres., Ford Motor Co.

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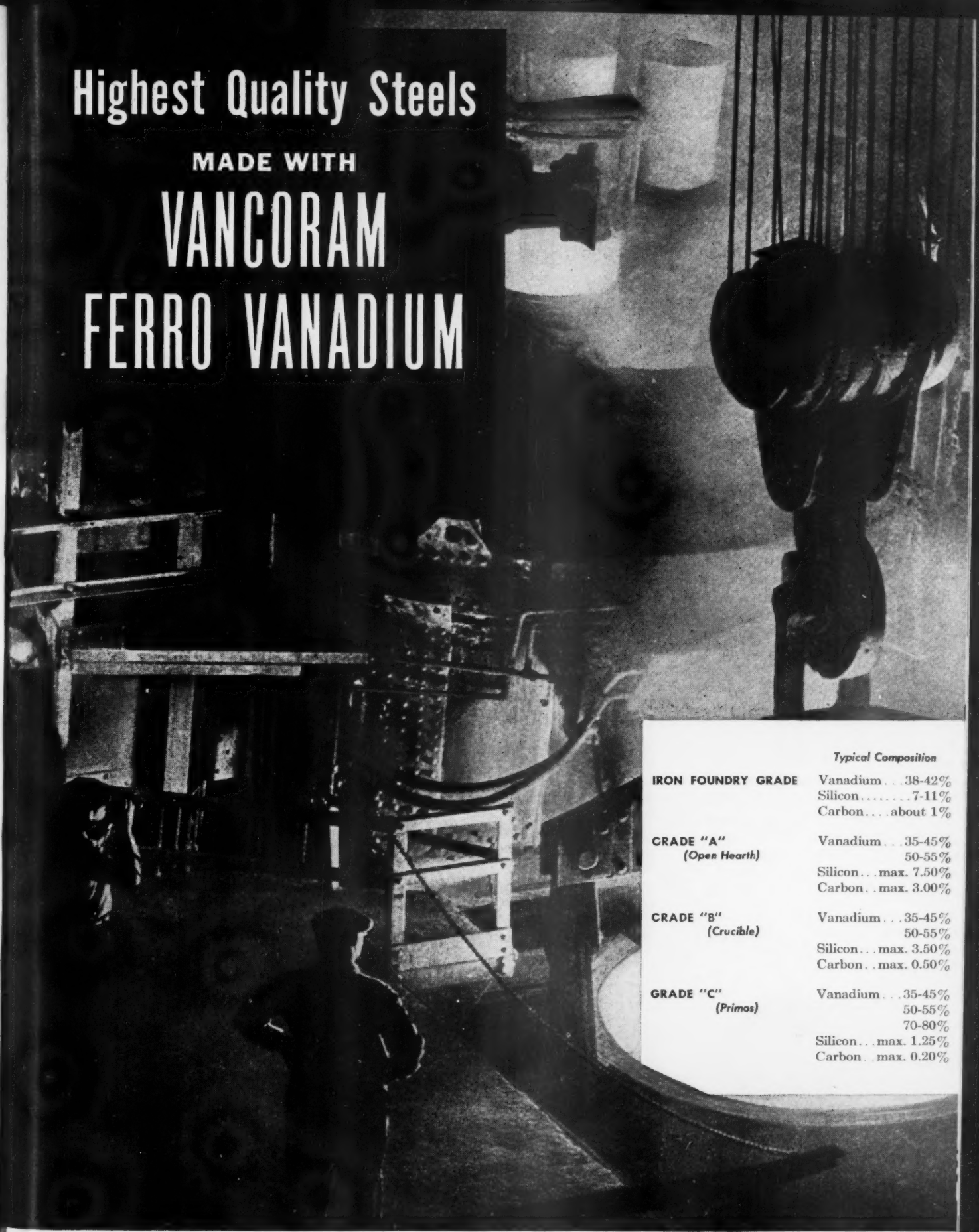

	Typical Composition
IRON FOUNDRY GRADE	Vanadium . . . 38-42% Silicon . . . . . 7-11% Carbon . . . . about 1%
GRADE "A" *(Open Hearth)*	Vanadium . . . 35-45% 50-55% Silicon . . . max. 7.50% Carbon . . max. 3.00%
GRADE "B" *(Crucible)*	Vanadium . . . 35-45% 50-55% Silicon . . . max. 3.50% Carbon . . max. 0.50%
GRADE "C" *(Primos)*	Vanadium . . . 35-45% 50-55% 70-80% Silicon . . . max. 1.25% Carbon . . max. 0.20%

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VANCORAM

CHEMICALS AND META

MEN *of Industry*

(*Continued from page* 130)

gineer. From 1941 to 1946 he was a research engineer specializing in internal combustion engines. He was staff engineer since 1946, in charge of research on pistons, piston rings, cylinder liners and bearings.

♦ ♦ ♦

George E. Tate, since 1946 assistant treasurer, Federal Foundry Supply Co., Cleveland, has been elected treasurer. He has been associated with the company 25 years. Prior to 1946 he was company purchasing agent.

♦ ♦ ♦

Norman F. Smith, since 1938 vice president-general manager, Osborn Mfg. Co., Cleveland, has been named president, succeeding his father, **Franklin G. Smith,** founder of the company and president since 1892, now board chairman. Norman Smith was graduated from Dartmouth College in 1925, when he became associated with the Osborn organization. In 1927 he was made assistant manager of Rubico Brush Manufacturers Inc., New York, then a newly acquired division of Osborn, and became treasurer in 1930. He was called back to Cleveland in 1935 to become treasurer of the parent company.

♦ ♦ ♦

Charles E. Newman has been appointed Chicago territory sales engineer, Surface Combustion Corp., Toledo, O., associated with **William M. Dempster** in the sale of all lines of standard industrial equipment produced by the company. Mr. Newman received his engineering background at Toledo University and joined Surface Combustion in 1936. For the last 7 years he has been associated with **A. H. Koch,** who is in charge of sales-service activities in the Toledo office.

FRED A. HARTLEY

Appointed in charge of the new Washington office opened by the National Foundry Association, as reported in January FOUNDRY

John M. Kane, since 1944 chief engineer of the Dust Control Division, American Air Filter Co., Louisville, Ky., has been appointed division manager. Mr. Kane joined the company in 1933 following graduation from University of Kentucky. Active in technical associations, he is currently serving as a member of the Safety and Hygiene Committee, American Foundrymen's Society.

♦ ♦ ♦

Charles Locke recently was appointed works manager, Atlas Foundry & Machine Co., Tacoma, Wash. Mr. Locke received a bachelor of science degree in metallurgy from Michigan College of Mining and Technology and master of science degree from Rensselaer Polytechnic Institute. In 1936 he was appointed assistant metallurgist, Dodge Steel Casting Co., Philadelphia, and two years later joined West Michigan Steel Foundry Co., Muskegon, Mich., where he was chief metallurgist and later general superintendent. From 1948 until his recent appointment at Atlas he was in the metals research department of Armour Research Foundation of Illinois Institute of Technology, Chicago.

♦ ♦ ♦

Dr. Robert F. Mehl, director of the Metals Research Laboratory and head of the department of metallurgical engineering, Carnegie Institute of Technology, has been granted leave of absence, to become chairman of the metallurgical advisory board, National Research Council.

♦ ♦ ♦

Dr. H. K. Ihrig, who resigned recently as vice president and director of laboratories, Globe Steel Tubes Co., Milwaukee, has been elected vice president in charge of research, Allis-Chalmers Mfg. Co., there.

♦ ♦ ♦

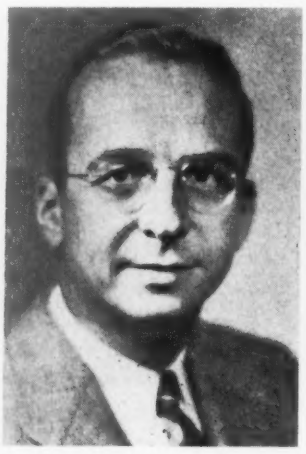
Norman C. Minehart has been elected vice president in charge of the Abrasive Division, Charles H. Besly & Co., Chicago, makers of abrasive wheels, grinders, etc. **Jack T. LeBeau** has been appointed manager of the abrasive department.

♦ ♦ ♦

Oscar Blohm, during the past year manager, core oil division Velsicol Corp., Chicago, and prior to that secretary-treasurer, Triangle Foundry Co., Chicago, has purchased an interest in the Curto-Ligonier Foundry Co., Ligonier, Ind., and assumed the posts of vice president and chief metallurgist. The company has facilities for producing gray iron, brass,

(*Concluded on page* 134)

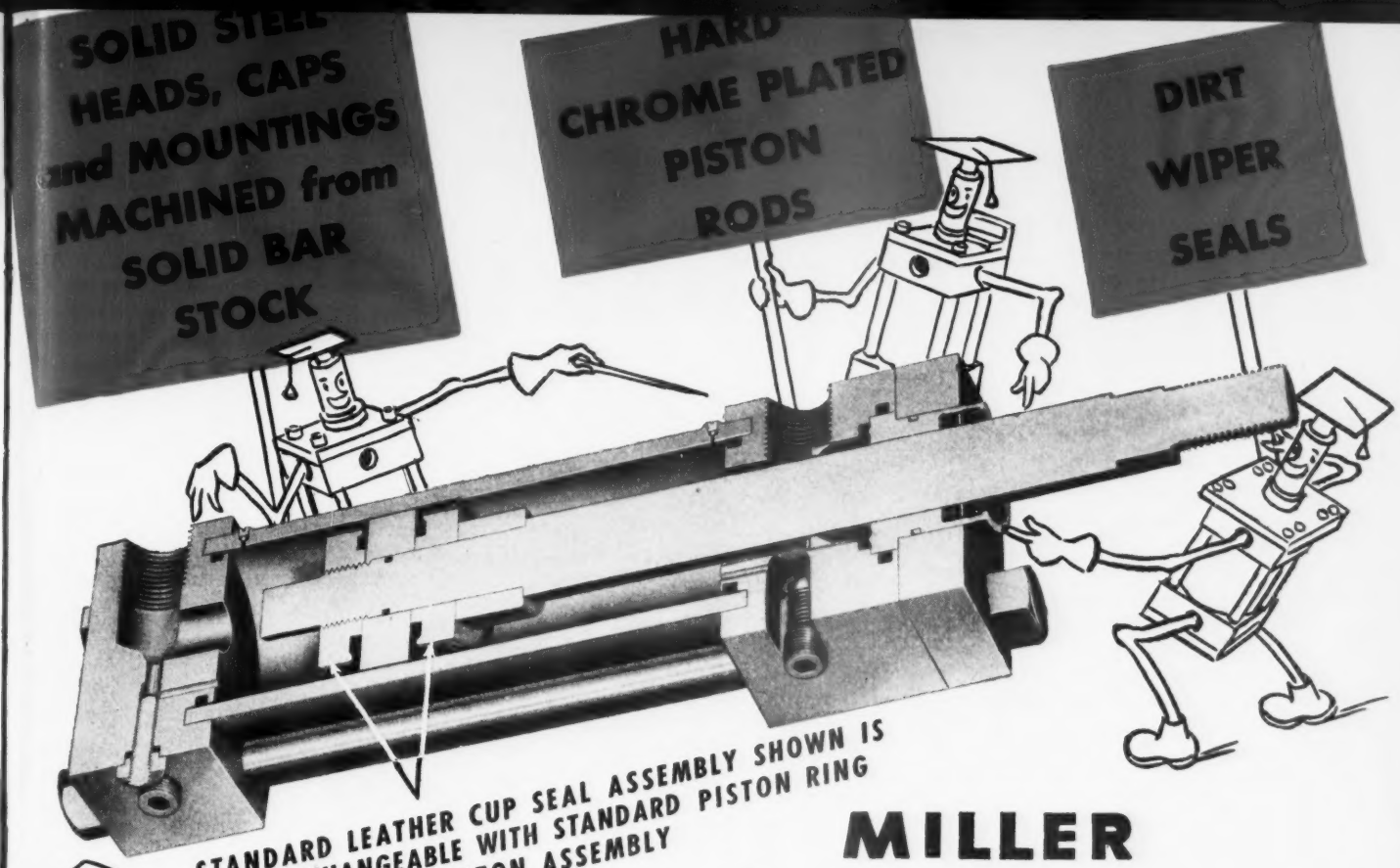
GEORGE E. TATE
. . . treas., Foundry Supply Co.



NORMAN F. SMITH
. . . pres., Osborn Mfg. Co.

CHARLES E. NEWMAN
. . . equipment sales, Chicago

JOHN KANE
. . . dust control engineer



STANDARD LEATHER CUP SEAL ASSEMBLY SHOWN IS INTERCHANGEABLE WITH STANDARD PISTON RING PISTON ASSEMBLY

MILLER *High Pressure* HYDRAULIC CYLINDERS

Meet J. I. C. HYDRAULIC STANDARDS

Years before the Joint Industry Conference (J. I. C.) Standards for specifying "quality" hydraulic equipment were adopted, the *standard* design and construction features of Miller High Pressure Hydraulic (2000-3500 psi) Cylinders already included ALL the specifications for cylinders, seals and pistons now called for by the "Standards". Hard chrome plated, scratch-resistant piston rods and dirt wipers have long been standard Miller cylinder features yet are required by the "Standards" only under severe conditions.

Solid steel heads, caps and mountings which eliminate costly, dangerous breakage even under the severest operating conditions represent an "extra-quality" standard Miller cylinder feature which actually exceeds the high quality set by the J. I. C. Standards.

The Miller "Patented" Hydraulic Piston Rod Seal which has no manual adjustment and is automatically self-adjusting and wear-compensating to give life-long leakproof service without ever requiring any manual adjustment whatsoever . . . far surpasses the requirement of J. I. C. Standard H6.2.5 which specifies "Stuffing boxes for automatic packing shall be so designed as to prevent adjustment beyond the functional limits of the packing"

Benefits to You

No Broken Castings

No Scratch-Damage to Piston Rods, Bushings and Seals

NO COSTLY "DOWNTIME"
NO REPAIRS
NO MAINTENANCE
NO POWER WASTAGE

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COMPLETE MILLER CYLINDER LINE INCLUDES: AIR CYLINDERS, 1½" to 20" BORES, 200 PSI OPERATION; LOW PRESSURE HYDRAULIC CYLINDERS, 1½" TO 6" BORES FOR 500 PSI OPERATION, 8" TO 14" BORES FOR 250 PSI; HIGH PRESSURE HYDRAULIC CYLINDERS, 1½" TO 12" BORES, 2000-3000 PSI OPERATION. ALL MOUNTING STYLES AVAILABLE.

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HARTFORD — NEW YORK CITY — DAYTON — ST. PAUL — FORT WAYNE — INDIANAPOLIS
MILWAUKEE — NASHVILLE — SEATTLE — LOS ANGELES — SAN FRANCISCO — BALTIMORE
ST. LOUIS and OTHER AREAS.

MEN *of Industry*

(*Concluded from page* 132)

aluminum and magnesium castings. **Jerry Curto** is president of Curto-Ligonier, **Frank Cygan** is vice president and **Robert Payne** is secretary-treasurer. The three latter were until several years ago affiliated with Acme Aluminum Foundry Co., Chicago.

♦ ♦ ♦

Earl C. Hughes, vice president and secretary, Bay State Abrasive Products Co., Westboro, Mass., has been re-elected president of the Grinding Wheel Institute, an association of 29 leading grinding wheel manufacturers in the United States and Canada. Mr. Hughes was graduated from Worcester Polytechnic Institute. He was associated with Norton Co., Worcester, Mass., from 1919 to 1936, when he joined Bay State Abrasive Products Co. as executive secretary and was named a vice president early last year.

♦ ♦ ♦

William S. Lowe, formerly executive vice president, A. P. Green Fire Brick Co., Mexico, Mo., has been elected president, succeeding **Robert S. Green,** resigned, who continues as a director. Mr. Lowe attended Cotner College and was graduated from South Dakota State College in 1931. Three years later he joined General Electric Co., where he became Bridgeport, Conn., division superintendent. From 1942 to 1944 he was assistant to the vice president of manufacturing, SKF Industries Inc., Philadelphia. Mr. Lowe, from 1944 to 1949, was board chairman and president, Winsted Hardware Mfg. Co., Winsted, Conn., director and treasurer, American Transformer Co., Newark, N. J., and vice president, the Waring Products Corp., New York. He joined A. P. Green Fire Brick Co. in August, 1949.

♦ ♦ ♦

Sherman B. Burke has been appointed Buffalo district sales manager, Hanna Furnace Corp., merchant pig iron division of National Steel Corp., Ecorse, Mich., succeeding the late Raymond T. Melville. For the last 15 years Mr. Burke has been in charge of the Boston district of Hanna Furnace. Prior to that he was in the Buffalo district office for 12 years. With headquarters in Buffalo he will continue to supervise the Boston office pending appointment of a successor there.

♦ ♦ ♦

J. H. W. Conklin, formerly sales manager, Industrial Truck Division, Clark Equipment Co., Battle Creek, Mich., has been appointed assistant sales manager of the Pangborn Corp., Hagerstown. Mr. Conklin was president of the Materials Handling Institute in 1949.

♦ ♦ ♦

Frank E. Hutton was recently appointed executive assistant, Babcock & Wilcox Co., New York, in charge of application and sales of alloy castings and other process equipment. A graduate of Washington University, Mr. Hutton joined the company in 1927 as an apprentice engineer. He has served in the Barberton, O., Bayonne, N. J., and Pittsburgh offices. Loaned to the government during Word War II, he has been with B & W's New York office for 5 years.

♦ ♦ ♦

Willis M. Peirce, assistant to the general manager of the technical department, New Jersey Zinc Co., Palmerton, Pa., has been elected president, American Institute of Mining and Metallurgical Engineers. **Joseph L. Gillson,** geologist, E. I. du Pont de Nemours & Co., Wilmington, Del., and **Michael L. Haider,** vice president-general manager, production department, Imperial Oil Ltd., Toronto, Ont., have been named vice presidents and directors for three years. **R. M. Brick,** department of metallurgical engineering, University of Pennsylvania, has been named chairman of the Institute of Metals Division.

♦ ♦ ♦

Erwin Steffens has been appointed head of the metallurgical department, Precision Scientific Co., Chicago, succeeding the late E. D. Holt. Mr. Steffens will be in charge of metallurgical investigation for all company divisions and manufacturing departments. Until recently he was associated with R. W. Hunt Co., Chicago, as metallurgist in charge of engineering.

♦ ♦ ♦

William J. Fleming, formerly vice president in charge of engineering, Trumbull Electric Mfg. Co., Plainville, Conn., subsidiary of General Electric Co., has been transferred to General Electric X-Ray Corp., Milwaukee, as vice president of engineering and manufacturing.

♦ ♦ ♦

Howard M. Palmer, until recently director of power division sales, has been appointed general sales manager, Lewis-Shepard Products Inc., Watertown, Mass., manufacturer of materials handling equipment.

♦ ♦ ♦

John Slezak, president, Turner Brass Works, Sycamore, Ill., has been named president of the Illinois Manufacturers' Association. **John F. P. Farrar,** president, Chicago Metal Hose Corp., Maywood, Ill., was elected treasurer.

EARL C. HUGHES
. . . grinding wheel executive

WILLIAM S. LOWE
. . . president, Green Fire Brick

SHERMAN B. BURKE
. . . sales mgr., Hanna Furnace

J. H. W. CONKLIN
. . . joins Pangborn Corp.

Apron Conveyors Are Unsurpassed for Handling Hot Sand and Castings from the Shakeout—Also Cut Time and Cost of Conveying Castings Through Cleaning Departments. Types, Sizes and Pitches for any Layout.

Compact System for Malleable Annealing, Showing Shakeout, Dust-Sucker Hood, Sorting Table Conveyor, Material Handling and Cleaning Equipment, Storage Bins, and Lowerator That Permits Each Pot in the Stack to be Packed at a Convenient Height.

Sand Control

cuts core costs

● Drying your own core sand results in better deliveries and lower sand costs. It permits exact duplication of every mix — saves on binders — results in a uniform bake — constant core structure and reduces losses of both cores and castings.

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If you don't agree that SUPER-ANNEALSHOT and GRIT are the best and most economical malleable abrasives you've ever used—return the unused quantity for refund—AT OUR EXPENSE.

Now you can take a better grip on any shot or grit problem. SUPER-ANNEALSHOT by Metal Blast is the perfectly screened shot, free from "tails" and "hollows". Cleans just as fast as ordinary chilled shot, but lasts about twice as long. All produced in automatic heat controlled furnaces. In some cases the change to SUPER-ANNEALSHOT has reduced costs as much as 80%.

Read the trial order guarantee above and send your order now, for if you're not convinced it's the best you've ever used, simply send the unused quantity back at our expense.

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872 East 67th Street · Cleveland 3, Ohio

To Stress Technical Developments at

AFS BUFFALO CONVENTION

AN interesting and informative program of technical papers and discussions is being readied for the 55th annual meeting of the American Foundrymen's Society, to be held in Buffalo, Apr. 23-26. Since no exhibit of foundry equipment and supplies is scheduled this year, emphasis at the meeting will be placed on technical developments in various phases of foundry practice.

Applications for hotel reservations during the week have been mailed from AFS headquarters to society members. These applications are to be returned to the Buffalo Convention Housing Bureau, which will handle room reservations.

As indicated by the accompanying tentative program, full technical schedules are planned by each of the major society divisions. The customarily popular shop courses will be conducted the first three evenings of the week, with the annual banquet concluding the four-day program Thursday evening.

Newcomer to an AFS convention technical program is a symposium on gating and risering, to be held at morning and afternoon sessions Tuesday. Jointly sponsored by the Aluminum and Magnesium, Brass and Bronze, Gray Iron, Malleable, and Steel Divisions, it will present outstanding authorities on this subject of widespread interest.

Other noteworthy features of the technical program will be the Charles Edgar Hoyt Annual Lecture and exchange papers from foundry groups abroad. James C. Zeder, director of engineering and research, Chrysler Corp., Detroit, is the 1951 Hoyt lecturer. The paper of the Institute of British Foundrymen will be given by E. S. Renshaw, head foundry metallurgist, Ford Motor Co. Ltd., Dagenham, England. Exchange paper from the Institute of Australian Foundrymen is "The Modification Technique of Aluminum-Silicon Alloys," by R. Dyke, Defense Research Laboratories, Maribyrnong, Victoria.

New officers and directors of the society will be elected at the annual business meeting Wednesday afternoon. Report of the AFS nominating committee to be submitted at Buffalo names Walter L. Seelbach, president and general manager, Superior Foundry Inc., Cleveland, and currently vice president of the Society, as 1951-52 president to succeed Walton L. Woody, National Malleable & Steel Castings Co., Cleveland. Nominee for AFS vice president is I. R. Wagner, director and former president, Electric Steel Castings Co., Indianapolis.

Nominees as directors for three-year teams are: Martin J. O'Brien Jr., works manager, Symington-Gould Corp., Depew, N. Y.; Harry W. Dietert, president, Harry W. Dietert Co., Detroit; Albert L. Hunt, works manager, National Bearing Division of American Brake Shoe Co., St. Louis; Dr. James T. MacKenzie, technical director, American Cast Iron Pipe Co., Birmingham; A. M. Ondreyco, plant manager, Vulcan Foundry Co., Oakland, Calif. Mr. O'Brien currently is on the board, filling the unexpired term of the late Alfred M. Fulton, Northern Malleable Iron Co., St. Paul.

As retiring president, Mr. Woody has been nominated for a one-year term as director. Officers and directors elected at Buffalo will take office immediately following the annual meeting of the board next July.

Committees have been formed by the host Western New York Chapter to handle arrangements for various activities planned for the Buffalo convention. Alfred A. Diebold, Atlas Steel Casting Co., the chapter chairman, is chairman of the general convention committee. Other members of this committee are: Vice chairman, Erwin W. Deutschlander, Worthington Pump & Machinery Corp.; secretary, Roger E. Walsh, Hickman, Williams & Co.; treasurer, Martin W. Pohlman, Pohlman Foundry Co.

TENTATIVE PROGRAM

55th Annual Meeting

Buffalo, Apr. 23-26, 1951

Monday, Apr. 23

8:30 a.m.—Registration begins
10 a.m.-12—Technical sessions: Aluminum and Magnesium, Brass and Bronze, Malleable, Heat Transfer
12 noon—Aluminum and Magnesium round table luncheon, Brass and Bronze round table luncheon
2-4 p.m.—Technical sessions: Malleable, Heat Transfer, Educational
5 p.m.—Registration closes.
6:30 p.m.—Educational dinner
8 p. m.—Technical session: Gray Iron Shop Course, Sand Shop Course, Brass and Bronze Sand Course

Tuesday, Apr. 24

8:30 a.m.—Registration begins.
9 a.m.-12—Symposium on Gating and Risering (jointly sponsored by Aluminum and Magnesium, Brass and Bronze, Gray Iron, Malleable and Steel Divisions).
12 noon—Malleable roundtable luncheon
2-4 p.m.—Symposium on Gating and Risering (continued)
4-6 p.m.—Technical Sessions: Aluminum and Magnesium, Pattern, Sand, Timestudy and Methods.
5:30 p.m.—Registration closes.
7 p.m.—Canadian Dinner
8 p.m.—Technical sessions: Gray Iron Shop Course, Sand Shop Course, Brass and Bronze Sand Course

Wednesday, Apr. 25

9 a.m.—Registration begins
10-12—Technical sessions: Brass and Bronze, Gray Iron, Sand, Cost
12 noon—Pattern roundtable luncheon
2 p.m.—Annual business meeting
2:45 p.m.—Charles Edgar Hoyt Annual Lecture
4-6 p.m.—Technical sessions: Refractories, Plant and Plant Equipment, Sand
5:30 p.m.—Registration closes.
7 p.m.—AFS Alumni dinner
8 p.m.—Technical session: Plant and Plant Equipment, Gray Iron Shop Course, Sand Shop Course

Thursday, Apr. 26

9 a.m.—Registration opens
10-12—Technical sessions: Gray Iron, Steel
12 noon—Gray Iron roundtable luncheon, Steel roundtable luncheon
2-4 p.m.—Technical sessions: Gray Iron, Steel
4-6 p.m.—Technical sessions: Gray Iron, Steel
7 p.m.—Annual banquet

I. R. WAGNER
Vice Presidential Nominee, 1951-52

W. L. SEELBACH
Presidential Nominee, 1951-52

Single Man Operatking both cope and drag**usly** (11" x 17" flask) at on**e** operator fills both cope **from** single, overhead h**opper**, automatically contro**l** Squeeze Stripper, then starts **a** cycle ...automatically jo**lts** off, moves squeeze hea**d** ion, squeezes, moves squ**eeze** out of position and draws **p**

THE OSBORN MANUFACTURING COMPANY

5401 Hamilton Avenue Cleveland 14, Ohio

squeeze on moulding costs

WITH NEW OSBORN AUTOMATIC CONTROLS

ANOTHER EXAMPLE OF OSBORN LEADERSHIP AND ADVANCED ENGINEERING

SIMPLIFIES MOULD PRODUCTION

The Osborn *fully automatic* Jolt Squeeze Stripper Machine shown is ideally suited for making both COPES and DRAGS SIMULTANEOUSLY in small flask moulding. The operator has only to fill the flasks, then start the machine cycle simply by pressing a button. The machine *automatically* does the rest . . . jolts, strikes off, moves squeeze head into position, squeezes, moves squeeze head out of position and draws the mould.

INCREASES YOUR OUTPUT

The pre-set machine moulding time is *accurately duplicated* on each mould. During the automatic cycle, the operator is entirely free to perform other operations in making moulds such as setting cores and closing the moulds. Each machine is an integral moulding unit where a majority of the moulder's time is spent in handling the flasks and completing moulds rather than operating the machine.

JOB PROVEN PERFORMANCE

Here is an operation successfully proven on small mould production of miscellaneous castings. It provides greater uniformity of moulds . . . more constant rate of production throughout the day, since one man performs the complete moulding operation instead of the two-man team where one, of necessity, is paced by the other.

INCREASES PRODUCTION

Foundries report substantial increases in man hour production using Osborn Jolt Squeeze Stripper Moulding Machines equipped with Automatic Controls. Why not have an Osborn factory-trained specialist analyze your smaller casting production for adaptability to this modern moulding method. The Osborn factory-trained foundry specialist will gladly recommend an overall, cost-cutting program to suit your exact mould production requirements. Simply call or write.

OSBORN®

MOULDING MACHINES

CORE BLOWING MACHINES

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

Industry BRIEFS

NEWARK Brass Foundry, 320 Schyler Ave., Kearney, N. J., has been sold to a new organization headed by Joseph Esposito, owner, Consolidated Pattern Works Inc., North Bergen, N. J. The plant will be operated under the name of Newark Brass & Iron Foundry Inc. Willard L. Jacobs, formerly plant manager of Lincoln Foundry Inc., South Plainfield, N. J., will serve in similar capacity with the new organization. Foundry was sold by Frank Hierwarter, who is retiring.

* * *

C. A. Goldsmith Co., 269 Thomas St., Newark, N. J., producer of nonferrous castings, has been sold to Somech Industries Inc., New York. Company will continue to operate under the same name with no change in general character of production. New company officers are: W. Page Taggart, president; Ellis Somech, vice president; David R. Ehrlich, treasurer, and L. Goldinger, secretary. Mr. Taggart formerly was sales manager of the old organization.

* * *

Gem Ware Mfg. Co., 1521 Compton Ave., Los Angeles, has changed its name to the Gaines Co., following acquisition by Frank E. Gaines, founder of the Aerol Co., a subsidiary of Lockheed Aircraft Corp. Company will operate under the new name but will continue to use the Gem Ware trademark on cooking ware and other products which include magnesium and aluminum castings.

* * *

J. O. Ross Engineering Corp., New York, has begun construction of a plant adjacent to its present manufacturing plant in New Brunswick, N. J. Of brick and steel, the addition will have approximately 75,000 sq ft of floor space and contain the local factory offices, enlarged testing and research laboratory.

* * *

Merger of Baldwin Locomotive Works, Philadelphia, and Lima-Hamilton Corp., Lima and Hamilton, O., has been completed. New company will be known as Baldwin-Lima-Hamilton Corp. Officers include: George A. Rentschler, board chairman, Marvin W. Smith, president, and Walther A. Rentschler, vice president in charge of the Lima-Hamilton Division. Other vice presidents of the division include A. A. Byerlein, H. F. Barnhart and C. T. Ziegler.

* * *

Syracuse Supply Co., Syracuse, N. Y., has been appointed central New York representative for the Ohio Tramrail line of cranes, transfer bridges and tramrail systems manufactured by Forker Corp., Cleveland. General sales of Syracuse Supply Co. are headed by Harold E. Torell, vice president. C. L. McGovern, manager of material handling and power transmission division, will direct Ohio equipment sales.

* * *

Bronze Bearings Inc. has been organized as a sales affiliation of S & H Bronze Bearings Inc., 340 North Ave., East, Cranford, N. J., producer of bronze bearings and nonferrous castings. The operating company was formed in August to acquire the property of S & H Bronze Bearings Corp., and was headed by Sidney Hausman, who now serves as president.

* * *

Barnett Foundry & Machine Co., 536 Lyons Ave., Irvington, N. J., has acquired the plant of Downs-Slater Iron Foundry Co., North Salem St., Dover, N. J. The Dover property will be devoted entirely to production of Meehanite castings.

* * *

Chemco Products Co., 7740 West 47th St., Lyons, Ill., has changed its name to Pelron Corp. Company manufactures core oils and pastes, cutting oils and rust preventatives.

* * *

Air Reduction Co., 60 East 42nd St., New York 17, has begun construction of a plant in Union, N. J., for manufacture of welding equipment, oxygen and acetylene manufacturing and distribution equipment. Of brick and steel construction, the plant will cover approximately 272,000 sq ft including 18,000 sq ft of office space.

* * *

Linde Air Products Co., unit of Union Carbide & Carbon Corp., 30 East 42nd St., New York 17, has begun expansion of its oxygen producing plant in East Chicago, Ind. Additional capacity will make East Chicago the largest single plant for production of high purity oxygen for the steel and metalworking industries.

* * *

Poole Foundry & Machine Co., 1700 Union St., Woodbery, Md., manufacturer of flexible shaft couplings, reduction, cast and cut gears, etc., is doubling its office space by erection of a two-story building. About a year ago the company completed a one-story addition, 60 x 120 ft, which was equipped for manufacture.

* * *

Blaw-Knox Co., 2028 Farmers Bank Bldg., Pittsburgh 22, has begun a $1-million expansion and modernization program at its Lewis Foundry & Machine Division, Groveton, Pa., to help meet the growing need for rolling mill machinery.

* * *

Aluminum Foundry Co., 816 East Pearl St., Cincinnati 2, has been purchased by Richard T. Stanton, former general manager of the firm, from Emil Albrecht, who operated the company for 28 years and now is retiring.

* * *

Grede Foundries Inc., Spring City Division, 901 West St. Paul Ave., Waukesha, Wis., is adding 12,000 sq ft of floor space in the form of three additional floors to an existing two-story building.

* * *

Bedford Foundry Division, General Motors Corp., Bedford, Ind., has changed its name to Fabricast Division. Fabricast formerly was part of the Allison Division, operating as Allis-Bedford Foundry.

* * *

Pufahl Foundry Inc., Como Ave., S. E. & City Limits, Minneapolis 14, suffered $200,000 fire loss to all but one of its buildings Nov. 30.

* * *

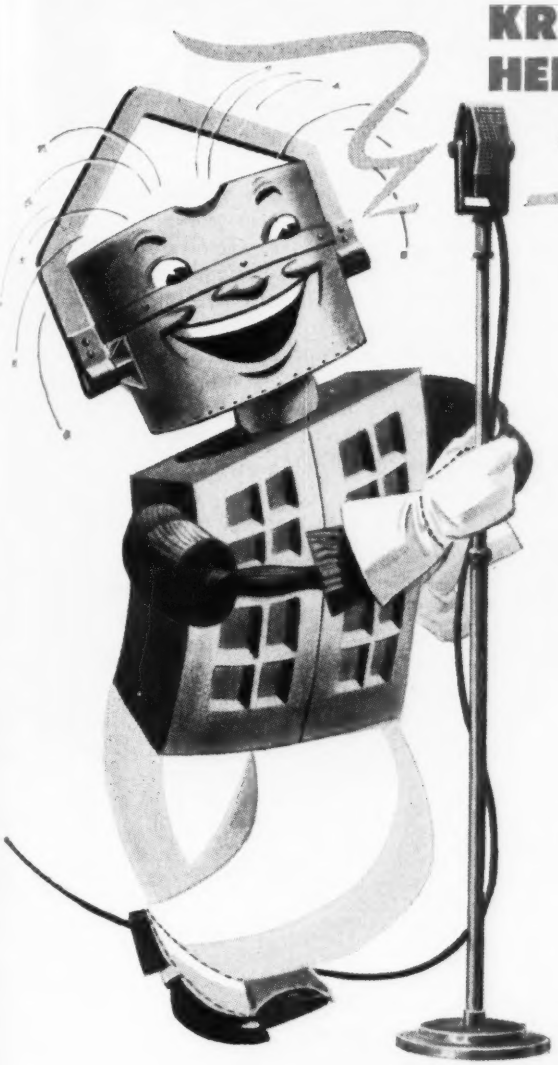
American Brake Shoe Co., Brake Shoe & Casting Division, 2001 Winchester St., Baltimore, is erecting another cupola building.

* * *

Central Foundry Co., 386 Fourth Ave., New York 16, has moved its offices to Murray & Pacific St., Newark 5, N. J.

Calling All Core-Makers...

KRAUSE CEREAL BINDERS HELP YOU TO GET FINER CORES AND CASTINGS IN 4 WAYS



1 GET MORE GREEN STRENGTH

2 IMPROVE FLOWABILITY AND TEXTURE

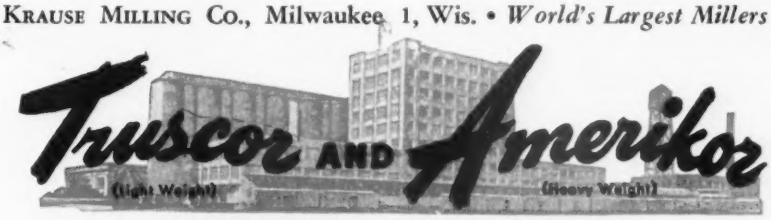
3 PRODUCE FINER DETAIL

4 GET EASY BURN-OUT, COLLAPSIBILITY

Krause Cereal Binders are made under time-tested formulas — their uniform quality is laboratory controlled.

Get the binder advantages you need and want — specify TRUSCOR if you like light weight; AMERIKOR if you prefer the heavy weight. Order from the distributors listed below or direct from us.

CHAS. A. KRAUSE MILLING CO., Milwaukee 1, Wis. • *World's Largest Millers of Dry Corn*



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M. A. Bell Co.
401 Velasco St.
Houston, Texas

M. A. Bell Co.
St. Louis, Mo.

A. L. Cavedo & Son, Inc.
Richmond 21, Va.

Foundry Supplies Co.
Chicago 16, Ill.

J. H. Hatten
Lansdowne, Pa.

Schuler Equipment Co.,
Birmingham, Alabama

Independent Foundry Supply
Co., Los Angeles 11, Calif.

Marthens & Co.
Moline, Illinois

Carl F. Miller & Co.
Seattle 4, Wash.

Milwaukee Chaplet & Mfg.
Co., Milwaukee 15, Wis.

Porter Warner
Industries, Inc.,
Chattanooga 2, Tenn.

Smith-Sharpe Co.
Minneapolis 14, Minn.

Snow & Galgiani
533-543 Second Street
San Francisco 7, California

Frederic B. Stevens, Inc.
Buffalo 12, N. Y.

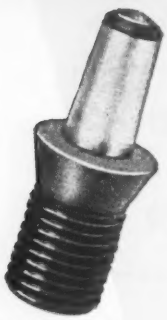
Frederic B. Stevens, Inc.
Cleveland 14, Ohio

Frederic B. Stevens, Inc.
Detroit 26, Mich.

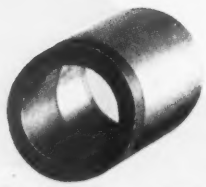
Frederic B. Stevens, Inc.
166 Brewery Street
New Haven 11, Connecticut

Western Industrial Supply Co.
208 S.E. Hawthorne Blvd.
Portland 14, Oregon

when you need CORE BOX PROTECTION ...it's MARTIN

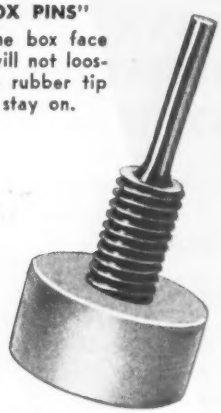


"PROTEXABOX PINS"
Cannot mar the box face because they will not loosen. Protective rubber tip guaranteed to stay on.



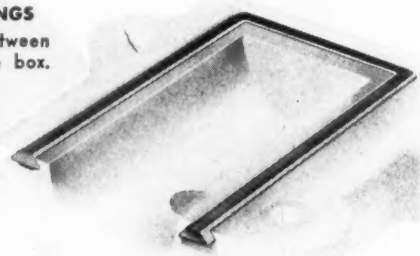
"SAND ARRESTER TUBE"
Save cores and step up production. Guaranteed for 100,000 blows.

Every Martin product is designed especially for "core box protection"—each is built to prevent a specific type of wear on your core boxes. They are engineered by foundry men to assure easy installation, successful operation. Martin products add years to the life of your equipment by enabling you to salvage old plates and core boxes, by preventing abrasion, and giving your plywood blow plates the lasting qualities of steel. Each product carries a guarantee of absolute satisfaction. Martin products are distributed all over the world by foundry supply houses.



"PULLINSERT" BLOW BUTTONS
Positively stop sand blasting under blow holes. Available in nine popular sizes.

"HOLINER" BUSHINGS
Stop abrasion between blow plate and core box. Protect blow holes.



"STRIPINSERT"
Protects parting line—easily installed in old or new boxes. Cutters for groove available at moderate cost.

"VIBROLATOR"

The powerful, all-directional vibration of the Peterson Vibrolator loosens materials that arch and resist motion, without damaging the face of core boxes, chutes or other mountings. Instantly self starting and virtually noiseless in operation, this new type vibrator eliminates maintenance worries and gives a long, dependable service life. No lubrication is necessary. The Vibrolator is light in weight to lessen fatigue and permit maximum delivery of vibration. There are five sizes available to meet all your foundry requirements. Peterson Vibrolators are sold only by Martin, exclusive manufacturers of ball-type vibrators.

"VIBROLATOR"

WRITE for folders describing these Martin products in detail. If you have a sand movement problem, send us complete information and our engineers will prescribe the correct vibrator for your needs.

MARTIN ENGINEERING COMPANY
KEWANEE, ILLINOIS

FOUNDRY PRACTICE FOR NONFERROUS CASTING ALLOYS

Introduction

In order to produce clean, sound castings, every step in the foundry must be controlled carefully. Gas porosity, shrinkage and defects resulting from poor sand conditions, in general, occur most frequently in nonferrous castings. Melting, molding and sand, respectively, control these defects. In view of their importance each of these phases of foundry operation will be treated separately to give the foundryman a permanent record of what is currently considered to be the best practices.

Melting

Gas porosity, sometimes referred to as "pin-hole" porosity, is caused by the separation of gases which are soluble in liquid metal and insoluble in solid metal. Separation takes place during the cooling cycle, particularly while the metal is changing from liquid to solid. Research has proved that reducing gases, principally hydrogen, dissolve in molten nonferrous alloys in much the same manner as water dissolves salt. At a given temperature water will dissolve only a definite amount of salt. If the amount of salt exceeds the solubility limit, salt crystals will be observed in the heretofore clear solution. If the temperature of a solution which has been saturated with salt drops one degree, the formation of salt crystals will result. The lower the temperature the more salt crystals form.

Metal, such as copper and aluminum alloys, exposed to reducing gases when molten, behave similarly when converted from molten to solid metal. If a metal and gas solution is visualized in the same light as water and salt solution, it will be understood how gas is released from solution in the molten metal as the temperature drops. When the metal solidifies it retains in solution only a fraction of the gas it dissolves when molten. Thus, it is obvious that the prevention of gas porosity is achieved by avoiding reducing melting conditions. Melting with the furnace atmosphere containing at least 0.5 per cent oxygen minimizes gas porosity.

At this point the reader might ask, "How can the proper atmosphere containing 0.5 per cent oxygen be detected in normal foundry practice"? Following are a number of ways by which melting conditions may be determined.

From 50th anniversary issue of *Lavingot* published by R. Lavin & Sons Inc., 3426 South Kedzie Ave., Chicago 23.

Flame Test

The appearance of the flame emitted from a crucible or oil-fired furnace is an indication of the melting atmosphere. A long, smokey, straw-yellow flame indicates reducing melting conditions which cause gas porosity. By reducing the amount of fuel or increasing the amount of air, the flame may be shortened to a point where it is incandescent containing only a trace of the straw-yellow color. This indicates slightly oxidizing melting conditions. Metal melted with this type of flame has a minimum of gas porosity in the resultant castings.

Zinc Test

This test has proved to be a very practical way of quickly determining melting conditions. A small piece of cold zinc about two inches square is held about one inch above the molten metal for about ten seconds. If after the zinc has been withdrawn a black carbon deposit is found, melting conditions are reducing and must be changed either by reducing the fuel or increasing the air until a gray deposit is observed on the zinc. Oxidizing melting conditions are obtained at this point.

Skimming Test

Still another method for determining melting conditions quickly is by observing the appearance of the virgin metal after it has been skimmed. If a bright, shiny surface is maintained in the wake of the skimmer, reducing conditions prevail. Adjustment of either fuel or air to a point where the surface of the metal in the wake of the skimmer becomes dull or oxidizes immediately, produces the desired oxidizing conditions.

Orsat Apparatus

If, because of furnace design it is impossible to make any one of the aforementioned tests or if the foundryman wants to be definitely sure that melting conditions are oxidizing, the use of the Orsat apparatus is recommended. This test which may be conducted in from five to ten minutes, depending upon the skill of the operator, actually determines quan-

FOUNDRY PRACTICE FOR NONFERROUS CASTING ALLOYS

titatively the combusted gases present in the atmosphere. The simplest form of apparatus provides for the determination of carbon dioxide, carbon monoxide and oxygen. It is obvious, of course, that the foundryman can then determine precisely if the oxygen content of the melting atmosphere is at least 0.5 per cent. Correlating the results obtained from an Orsat apparatus with results from the flame test, the zinc test and/or the skimming test will give the operator sufficient experience in determining melting conditions so as not to require frequent use of the Orsat apparatus.

Corrective Measures

Certain types of furnace design are not conducive to maintaining oxidizing melting conditions. In these cases it has been found that a treatment of the molten metal with an oxide, such as cuprous oxide and manganese dioxide, minimizes gas porosity to a considerable extent.

Shrinkage Porosity

Shrinkage characteristics of alloys differ. Aluminum bronze and manganese bronze have high shrinkage characteristics which must be controlled by the use of adequate risers and gates. The red brass alloys because of their low shrinkage characteristics do not require the extensive risers needed to feed manganese bronze and aluminum bronze castings.

Risers, gates and pouring temperature are major factors which control shrinkage. If this type of defect is encountered in the casting, one or more of these factors is usually the cause. This is quite a study in itself and because each casting presents new problems it is not possible to go into detail on this subject in the limited space provided herewith.

Sand

The properties of sand are very important in the production of quality castings. Sand holes in the surface of castings generally can be traced to weak sand, while blows in the surface of the casting may be caused by wet sand, hard ramming and close sand (low permeability). After a sand has been used for a while the bond burns out, the permeability decreases and the strength decreases. As the strength decreases the molder tends to ram harder in order to obtain strength and to avoid washing. This is usually combined with high moisture and low permeability which causes sand defects in the casting.

New sand of the proper strength and permeability should be worked into the heap at regular intervals to avoid such a condition.

The properties of sand for different types of work vary with the size and weight of the casting, the alloy and the type of surface desired. It is therefore impossible to cover all conditions in this brief outline. However, the everage brass casting with about ½-in. section thickness can be made in a sand having the following properties:

AFS Permeability	20
Green Compression Strength, psi	7
Moisture, per cent	6.5

Permeability and green compression strength increase with section thickness and weight. For example, a 6-in. section thickness and 1,000 lb casting should be made in a sand having the following properties:

AFS Permeability	100
Green Compression Strength, psi	15-20
Moisture, per cent	5.0

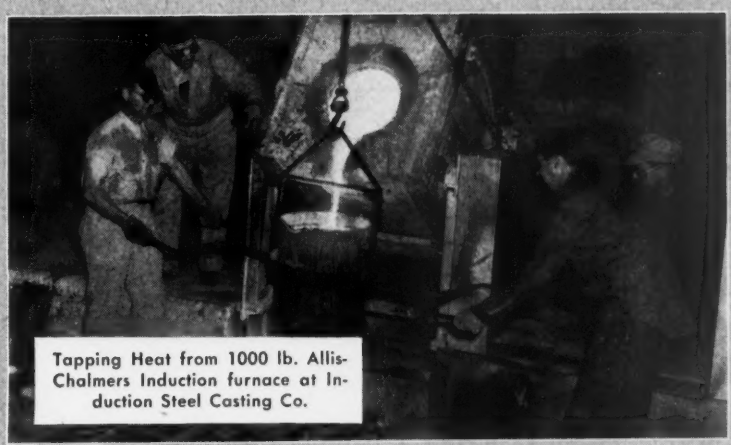
The following properties are typical of sands used for aluminum alloys:

AFS Permeability	5
Green Compression Strength, psi	7
Moisture Content, per cent	6-7

Unless a sand of such low permeability is properly conditioned and the moisture content closely controlled, the fineness of the sand will tend to produce blows and gas porosity in aluminum castings. Whenever casting surface requirements permit the use of coarser grades of sand, the factor of molding sand as a source of gas porosity in aluminum castings may be eliminated by the use of sand having an AFA Permeability of 25 or more.

TAM* Zircon grog type ramming mix

Linings always last over 200 heats at Induction Steel Casting Company



Tapping Heat from 1000 lb. Allis-Chalmers Induction furnace at Induction Steel Casting Co.

*TAM zircon lining after drying out...ready for first melt.

Furnace ready for relining after 261 heats.

The experience of Induction Steel Casting Company of East Detroit, Michigan is typical of the extended lining service life that can be expected from TAM* zircon grog type ramming mix. Their lining life is always over 200 heats.

The 1000 lb. induction furnace shown here was used to melt 261 heats before relining was required. During this period, S.A.E. 1025 and 1030, 12% Cr. —1½%C., 4630, 6145 and die steel containing .50C. and 1.0% Cr. were the alloys poured.

This long service and resultant increased furnace efficiency is due directly to the excellent resistance of TAM* lining material to high temperatures and erosive action. It explains why more metal is melted at less cost per ton when TAM* ramming mixes are used.

Detailed facts on TAM* ramming mixes may be obtained from our field engineers or by writing our New York office. It will pay you to have these facts.

TAM PRODUCTS
Registered U. S. Pat. Off.

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NATIONAL LEAD COMPANY

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Compressed Air Provides

Versatile Power Supply

A TYPICAL example of the versatility of compressed air as a source of power is provided by Schaefer-Goodnow Foundries Inc., Pittsburgh. This company, founded in 1930, specializes in semi-production of gray iron castings weighing from one-quarter to 1000 pounds. Light-section castings are furnished users ranging from steel mills to manufacturers of water heater stoves.

The foundry has 29 air stations located throughout the plant from which workers can draw a constant flow of air for many uses. Sand rammers, molding machines, sand sifters, several types of vibrators and clamps for holding work are air operated. Air hoists and lifts assist in handling work. Pneumatic hammers, drills and grinders are used in different operations. Castings are cleaned by air sandblasting or air-operated wire brushes. Machines and cores are cleaned by blowing off with air.

The power source for all the foundry operations dependent upon air in this plant is a horizontal single-stage compressor producing 315 cubic feet of air per minute at a maximum of 125 psi pressure. The compressor is in constant operation during the working day, with an estimated 15,000 cubic feet of air used each hour (Fig. 2).

From the air receiver in the compressor room, the air is piped into three sections of the plant. In the coreroom, air power is used by the sand rammers, of which there are two types—the bench rammer for light mold and core work, and the floor type for heavy ramming (Fig. 1). Originally sand rammers were used principally because of their labor-saving value. Experience has shown that there is a decided improvement in the quality and uniformity of castings when molds are rammed by them. Air is also used here for applying core paste, blowing cores, core breaking, and in an air hoist.

Compressed air hoists are used to handle patterns, large cores and molds. The overall cost of operating an air motor hoist is held down by

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Fig. 1—Using a floor type sand rammer

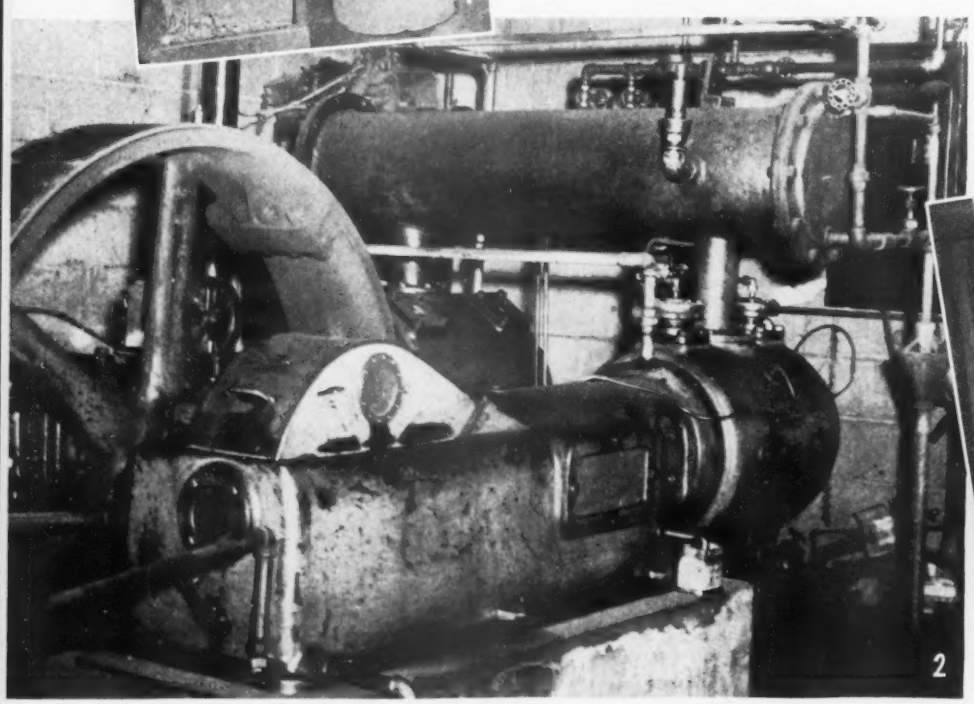
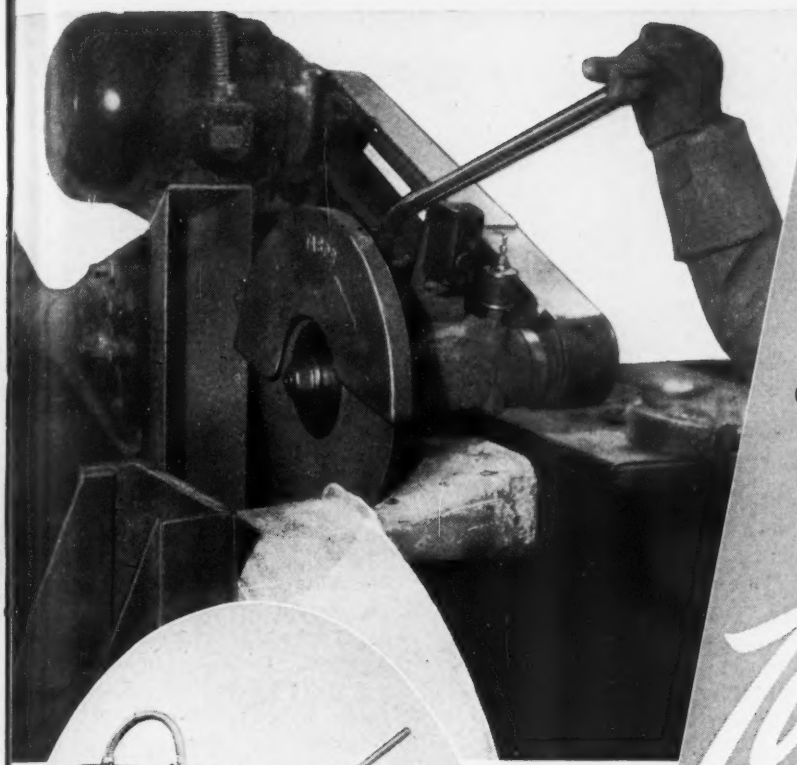
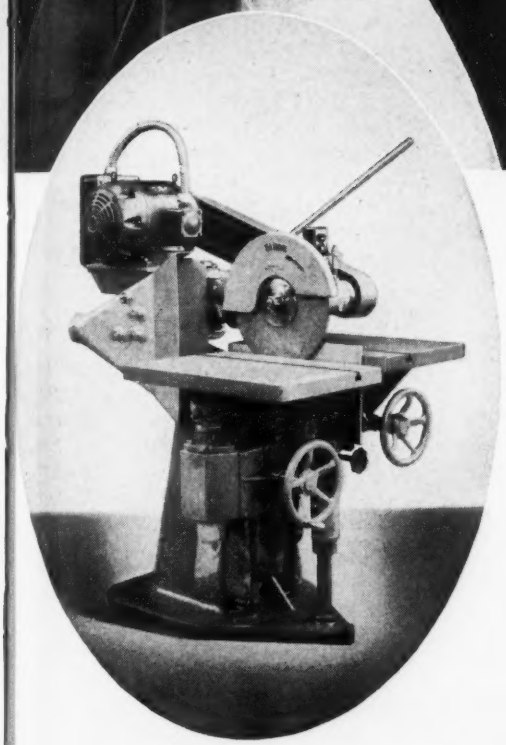


Fig. 2—This air compressor supplies 28 stations a total of 315 cubic feet per minute at 125 psi maximum pressure

Fig. 3—Typical chipping hammer



Through 21 sq. inches of manganese bronze in 10 Seconds!



That's a mighty fast cut for a 16" wheel driven by a 10 H.P. motor—a good example of how top-speed production schedules are "meat" for Tabor-Brasive Cut-Off Machines.

These rugged machines cut gates and risers from non-ferrous and ferrous castings in a matter of seconds. Clean, close cuts, too, that slash snagging and finish-grinding costs to the bone—often do away with them entirely.

And for the *really tough* cutting jobs—in steel foundries—in copper cutting (either gates and risers or crucible feed stock)—wherever the going's the toughest, Tabor makes a big-value 15 H.P. cut-off.

Any way you look at it, a Tabor-Brasive Cut-Off Machine—equipped with today's hard-to-break, safe-to-use wheels—is *your* answer to more cuts at less cost, with safety.
Write, wire or 'phone for more details.

SPECIFICATIONS

Motor	Table Size (Split Type)	Wheel Diam.	Max. Height of Work Under Wheel
10 H.P.	36" x 25"	16" Max. Thickness—5/32"	20" (with head over table) 46" (with head swung to side)
15 H.P. (Two Speed)	41" x 30"	20" Max. Thickness—3/16"	18" (with head over table) 44" (with head swung to side)
All motors fully enclosed, fan-cooled, ball bearing			

REPRESENTATIVES
Snyder Foundry Supply Company, Los Angeles Calif.; The Pacific Graphite Company, Inc., 40th & Linden Sts., Oakland 8, Calif.; Carl F. Miller & Company, Seattle, Washington; Harry H. Reich, Trussville, Ala.

The TABOR Manufacturing Co.

SINCE 1884 MANUFACTURERS OF FOUNDRY MOLDING MACHINES
6225 TACONY STREET • PHILADELPHIA 35, PENNA.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

EXPORT DEPARTMENT, 765 DREXEL BLDG., PHILA. 6, PA.

(*Concluded from page* 146)

the fact that its flexibility and accurate control enhance the operator's efficiency.

On the machine molding floor eight air stations are maintained. Air is used for the squeezer, and jolt roll-over molding machines. Ease and convenience of operation are outstanding features of pneumatic molding machines. A knee valve at the left controls the vibrator which, in operation, is attached to the matchplate pattern. The knee valve at the right controls the jolt.

Air power is the best known motive force for jolting, as a variable valve arrangement permits striking a jolt blow of almost any length and hardness.

In cleaning the castings, air is used to operate the chipping hammers (Fig. 3). Operating the average size chipping hammer under normal conditions uses 30 cubic feet of free air per minute. With a 40 per cent factor of use, this would equal 720 cubic feet per hour. At a cost of 5 cents per thousand cubic feet of air, the cost of the operating tool is only 3½ cents an hour.

On the far wall of the plant, 11 air stations supply power to the vibrators and cleaning jets. A knee-valve is used for operating the vibrator (Fig. 4).

For cleaning the castings, this company has a large sand blasting room and a small blasting barrel. Air mixed with sand cleans the castings of scale and other adhering matter (Figs. 5 and 6).

Data and photos for this article were obtained by the Compressed Air and Gas Institute through the courtesy of Schaefer-Goodnow Foundries Inc., Pittsburgh.

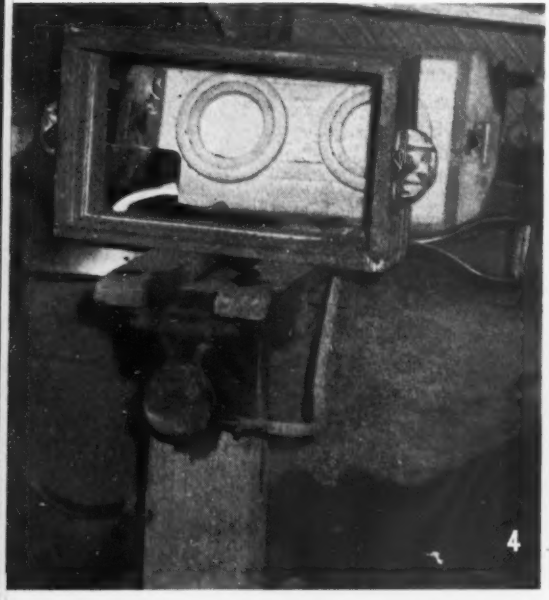


Fig. 4—Vibrator is operated by pressing plate in center

British Steel Founders Hold Annual Dinner

Shown left to right at the speakers' table at the British Steel Founders' Association annual dinner are: Lt. Col. Lord Dudley Gordon, Sir Robert Sinclair, Frank W. Rowe, Rt. Hon. Viscount Davidson, and T. H. Summerson

BRITISH Steel Founders' Association held its annual dinner Dec. 6 at Claridge's Hotel, London. Frank W. Rowe, managing director of K & L Steelfounders & Engineers Ltd., and association chairman, presided. Principal guests were Sir Robert Sinclair, president, Federation of British Industries; The Rt. Hon. Viscount Davidson, president, Engineering Industries Association, and a director of Dorman Long & Co., and Sir Alexander Ramsey, director, Engineering & Allied Employers' National Federation.

D. W. L. Menzies, chairman, Industrial Health in Steel Foundries Committee of the British Steel Founders' Association, proposed the toast to the guests. Reply to the toast, "The Steel Founding Industry," was made by T. H. Summerson, chairman, Thomas Summerson & Sons Ltd. and vice chairman of BSFA.

In their speeches, Messrs. Rowe and Summerson reviewed progress made in the past year by British industry, and particularly by the steel casting industry.

The steel casting industry of Great Britain comprises some 80 firms, majority of which are represented in the association. It tackles many industrial problems which it believes can be solved by co-operative effort. The Anglo-American steelfounding productivity team, the first to visit the United States under F. A. Martin, then association chairman, was supported by the association.

Films Cover Safety Talks

"Speaking of Safety," a new series of six training films showing supervisors and foremen how to address and conduct meetings, has been prepared by National Safety Council, 425 North Michigan Ave., Chicago 11. The films are standard, 35mm soundslide, with 16-in. records, 33⅓ rpm. About 13 minutes is required for showing each film. They are offered for sale by the council.

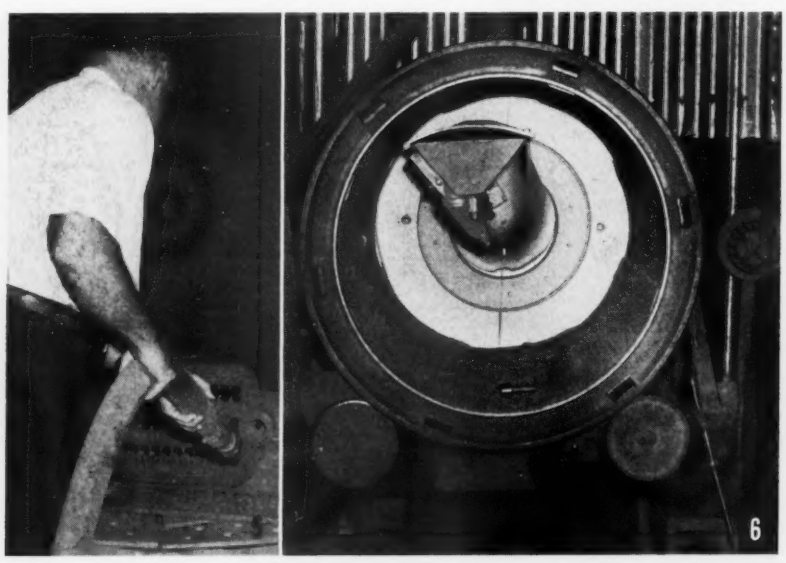
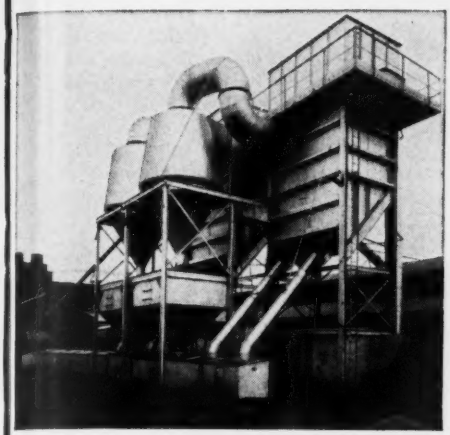


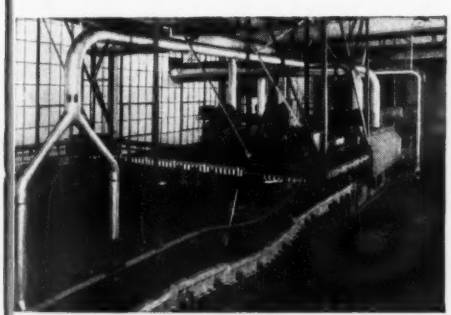
Fig. 5—Nozzle of sandblast equipment used to clean large castings
Fig. 6—Small castings are cleaned automatically in this barrel blaster

Solve Your Problems..with Schmieg CENTRI MERGE



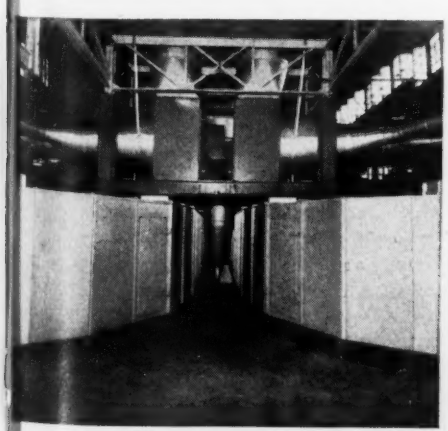
Cyclone Collector

Installed with cloth screen arrester on exhaust system for foundry and cleaning room. An arrangement, worked out by Schmieg engineers, by which the collector was installed ahead of the arrester greatly lengthened the life of the screens by reducing dust concentration.



Exhaust System

A typical exhaust system for foundry cleaning room equipment, such as wire brushing machines, etc., illustrates the advantages of using Schmieg equipment to solve dust and fume problems.



Hoods and Exhaust

No loss of efficiency caused by dust and fumes with these Schmieg hoods and exhaust system for foundry mould conveyor.

what HAPPENS... TO DUST, FUMES and SMOKE in your plant?

Are they collected completely as soon as they occur, cleaned from the air and quickly disposed of? Before they become a menace to health and a fire hazard, or a cause of lowered employee efficiency?

IF NOT—better consider right now the many advantages of a completely automatic Centri-Merge unit which collects dust, fumes and smoke quick as a flash, washes and scrubs them from the air by high pressure water action for convenient disposal as sludge.

Centri-Merge is the easy and economical air-cleaning system for any plant application. It gives non-fluctuating cleaning efficiency *all the time*, never requires a shutdown for cleaning or routine maintenance during working hours, and is engineered to occupy a minimum of valuable floor space and to save maintenance dollars.

Better consult Schmieg engineers today for the best answers to dust, fumes and smoke control questions, or write for detailed information.

THE best AIR PURGE is CENTRI MERGE

Schmieg INDUSTRIES INC.
Engineers & Manufacturers

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AROUND THE COUNTRY

NEW YORK — Business in iron castings is picking up rapidly. Some district foundries have as much as three-months' backlog and an increasing number are operating six days a week. The pig iron stringency is inducing district foundries to direct more attention to imported iron. Some admit they have held off too long, finding it difficult to obtain early shipping promises from importers, some of whom are booked through the first half. It is still possible, however, to obtain small quantities from European producers within several weeks, and some Chilean iron, only recently placed on the market here, can be shipped before the end of the current quarter.

While most nonferrous foundries are busy, restrictions on aluminum and copper for nonrated work are retarding production, as also is scarcity of skilled labor, a situation affecting all branches of the foundry industry in this district.

Meanwhile, foundry wage rates in the district are becoming stabilized. At the the close of last year eight gray iron foundries, with AFL unions, granted a 12½-cent-per-hour increase to all employees. The contract extends through Dec. 31, 1951. Under the new schedules journeymen molders and coremakers receive an hourly rate of $1.785 and common labor $1.235. There were no adjustments as to fringe issues. Since then settlement of negotiations at some other foundries, not necessarily AFL shops, have followed the same pattern.

* * *

DETROIT—Expansion of Ford Motor Co.'s foundry capacity will be accompanied by additional coke producing facilities. The company now has 183 ovens at the Rouge. Annual capacity of 1,225,000 tons of coke will be increased to 1,430,000 tons with the building of 37 more ovens. Work on the ovens will start shortly and is expected to be completed late this year. Enlarged foundry capacity the ovens will serve includes the huge new Cleveland plant now under construction, a new specialty foundry at the Rouge and expansion of the Dearborn iron foundry.

Ford has postponed indefinitely its plans for a new administrative center, including an 11-story building for staff offices and a six-story building for Lincoln-Mercury Division headquarters. Shelving of plans is a casualty of the national emergency.

General Motors has started a $1,500,000 research project to promote better health for its employees. With the University of Michigan it is establishing the Institute of Industrial Health at Ann Arbor, Mich., whose broad objectives will be research, education and service in industrial medicine, health and safety. Findings of the institute will be made available throughout all industry.

* * *

PITTSBURGH — Pertinent questions as to what castings foundries will be able to produce and in what quantities, may be at least partially answered by time this report is published. Around mid-January the trade expected NPA to issue soon a regulation covering pig iron distribution, based on individual producers' base-period distribution pattern. This would be adjusted to meet increased requirements of foundries serving railroad freight car and other essentially classified programs.

In addition to minimizing cross hauling, the pig iron allocation order—if and when issued—likely will result in a substantial cut-back in monthly quotas for foundries making castings for nonessential end uses. A general conservation order, banning production of certain items, also may be formulized in near future.

Raw material shortages already have forced significant cut-backs in projected production schedules of radiation, enamel ware, and other consumer durable goods items, causing a proportionate reduction in casting requirements. However, with exception of the nonferrous group and some small jobbing shops, most foundries continue operating at practical capacity. Jobbing foundries say orders do not warrant more than one shift 5 days per week, while nonferrous casting output has been reduced, cut by NPA regulations covering use of copper, tin, zinc and nickel. Many nonferrous foundries have appealed to NPA for relief through the first quarter, contending that such important expansion programs as now under way in the steel industry will be retarded. It is pointed out, for example, that nonferrous castings are used for rollout table bearings, screw box nuts, blast furnace tuyeres, terminal heads on electric furnaces, etc.

Foundries serving heavy machinery and machine tool builders are assured of full production schedules through 1951. Another important influence on foundry activity over coming months is the expected sharp increase in cast armor demand. To help supply these requirements, the Union Steel Castings Division of Blaw-Knox is adding a large building here to house heat treating and shipping facilities which will permit a 400 per cent increase in cast armor output. Consideration also is reported being given to the reopening of a government-owned foundry in East Chicago, which produced at rate of 12,000 tons per month during the last war.

Rising production costs since last September, ranging from $2 to $8 per ton for such items as coke, pig iron, cast scrap and refractories, in addition to advance of 7½ cents an hour in wages, forced most jobbing shops here to advance casting prices about 10 per cent early this year. The increase matches the same percentage advance last September. Many foundries expect prices of No. 1 cupola yard scrap, No. 1 machinery and other foundry grades will be rolled back to more realistic relationship with that of pig iron when price controls are put into effect.

* * *

CHICAGO — Jobbing foundries in this district are beginning to book defense orders as prime contractors fan out subcontracts. Such bookings are welcomed because of the growing scarcity of pig iron, coke and alloys. Ratings aid in obtaining materials and will help to retard layoffs of workers as civilian goods production becomes critical.

Both pig iron and foundry coke are on strict allocations by suppliers. A shop choosing to increase its melt can do so only by purchasing foreign iron, using more scrap and augment-

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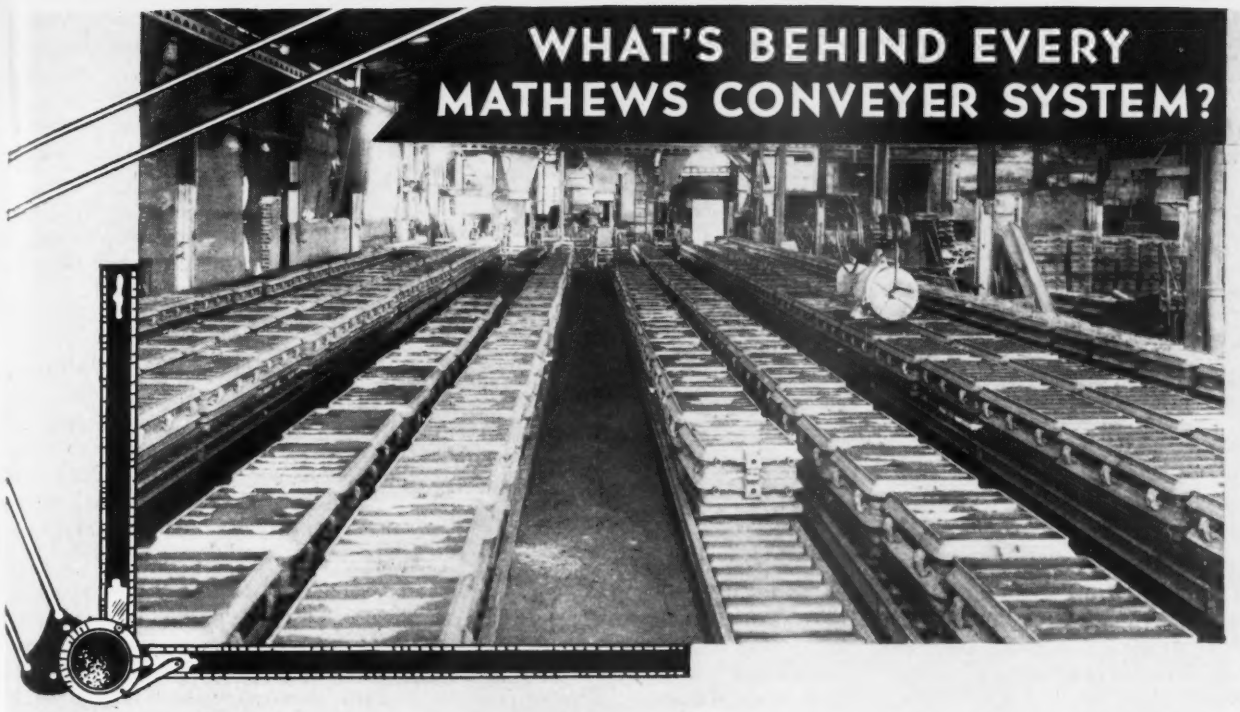

3 WELL-EQUIPPED PLANTS

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PORT HOPE, ONTARIO

Engineering Offices or Sales Agencies in Principal American and Canadian Cities

(*Concluded from page* 150)

ing fuel with beehive coke shipped from the East. Foreign iron laid down in Chicago costs between $90 and $100 a ton and the price trend is upward. Iron from the Continent runs high in phosphorus. Some Swedish charcoal iron has come in and occasionally African iron is offered.

Foundry scrap has risen to very high price levels. Recently it has been purchased to accommodate only immediate needs, in anticipation of scrap price control and a rollback to lower levels, It is estimated that foundries in this district are operating at about 75 per cent of capacity, the rate being geared to raw materials supply.

Shortages of nonferrous metals and alloys is giving concern in this area because of an increasing number of thefts of these materials. Between Dec. 9 and Jan. 6, scarce metals valued at more than $40,000 were stolen from six companies. Bulk of this consisted of nickel, cadmium and silver anodes taken from electroplating shops. However, Alloys Foundry Co., Chicago, lost almost a ton of monel metal and chromium valued at about $3500. Included was 750 pounds of monel metal castings; two barrels of the metal, each containing 500 pounds; an undetermined number of monel ingots; and 100 pounds of chromium ingots. Seemingly, it would be difficult for the thieves to sell the castings because of the ease with which they could be indentified.

* * *

LOS ANGELES — District foundries, operating at near-capacity levels, are feeling the impact of accelerated defense production. Volume of DO rated orders is small, but increasing steadily. Backlogs of aluminum foundries range up to 80 per cent DO business and bronze foundries up to 50 per cent. But many district foundries supplying customers not yet in defense production hold very little rated work.

Aircraft industry requirements for cast gray iron forming dies are higher. Demand is increasing from makers of motors and oil country tools, and machine shops are active. Backlogs of nonferrous foundries range 2 to 4 months. Most foundries are working five-day, nine-hour schedules, with some gray iron shops working six days. Raw materials supplies are good and operations are not limited by shortages.

NPA orders are causing difficulty. Some district foundrymen, unable to cope with DO order interpretations, are asking customers to state in writing that DO requirements are met before accepting business. Nonferrous foundrymen say NPA Order M-12, amended Dec. 30, 1950, limiting use of copper in construction, will put out of business some foundries whose backlogs are top-heavy with civilian work. There isn't enough rated work yet to support their operations, they say.

While no Los Angeles foundries are closed by smog regulations, many are operating under variance permits issued since establishment of minimum smoke emission standards by the Los Angeles County Air Pollution Control District in 1948. Numerous foundries, whose variances are expiring, have applied for continuances.

Meetings of Interest to Foundrymen

Feb. 8-9—Wisconsin Regional Foundry Conference, sponsored by Wisconsin Chapter of AFS and University of Wisconsin, Schroeder Hotel, Milwaukee

Feb. 22-23—Birmingham Regional Foundry Conference, Birmingham District Chapter and University of Alabama Student Chapter of the AFS, Tutwiler Hotel, Birmingham

Feb. 23—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Mar. 2—Malleable Founders' Society, eastern sectional meeting, Hotel Commodore, New York

Mar. 5-9—American Society for Testing Materials, committee week, Netherland Plaza Hotel, Cincinnati

Mar. 9-10—Ohio Regional Foundry Conference, sponsored by Ohio Chapters and Ohio State University Student Chapter of AFS, Case Institute of Technology, Cleveland

Mar. 19-21—Steel Founders' Society of America, annual meeting, Edgewater Beach Hotel, Chicago

Mar. 19-23—Western Metal Congress & Exposition, Civic Auditorium, Oakland, Calif.

Mar. 23—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Apr. 2-4—American Institute of Mining and Metallurgical Engineers, National Open Hearth Conference, Cleveland

Apr. 23-26—American Foundrymen's Society, annual convention, Buffalo

Apr. 27—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Apr. 30-May 4—Material Handling Institute and American Material Handling Society, exposition and conference, International Amphitheatre, Chicago

May 18—Malleable Founders' Society, eastern sectional meeting, Hotel Commodore, New York

May 23-24—American Society for Quality Control, annual convention, Hotel Cleveland, Cleveland

May 25—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

June 4-6—French Foundry Association, foundry congress, Paris, France

June 12-15—Institute of British Foundrymen, foundry congress, Newcastle-on-Tyne, England

June 18-22—American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hotel, Atlantic City, N. J.

June 21-22—Malleable Founders' Society, annual meeting, the Homestead, Hot Springs, Va.

July 27—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Sept. 10-14—International Foundry Congress, Brussels, Belgium

Oct. 15-19—American Society for Metals, annual meeting and exhibit, Michigan State Fair Grounds, Detroit

Oct. 25-26—Gray Iron Founders' Society, annual meeting, Edgewater Beach Hotel, Chicago

Oct. 31-Nov. 2—Foundry Equipment Manufacturers' Association, annual meeting. The Homestead, Hot Springs, Va.

Nov. 7-9—Meehanite Casting Manufacturers, annual meeting, the New Yorker, New York

Nov. 7-9—National Foundry Association, annual meeting, Shoreham Hotel, Washington

Dec. 6-8—American Institute of Mining and Metallurgical Engineers, Electric Furnace Steel Conference, Hotel William Penn, Pittsburgh

NOW- LOTS OF *Cupoline* AVAILABLE FOR IMMEDIATE SHIPMENT!

Our first plant for Cupoline went into production in October, 1949. Very shortly, it was operating 24 hours a day and seven days a week. The plant was enlarged *ten times* in size in June, 1950. It was enlarged another 20% in September, 1950.

Now, a completely new and separate plant is in production and gives us a further 125% expansion in capacity. That means prompt shipments in any quantity.

* * *

Cupoline, as used in the Bondactor Process for cupola patching, means:
(1) speed in patching;
(2) a very substantial reduction in costs;
(3) better cupola control.

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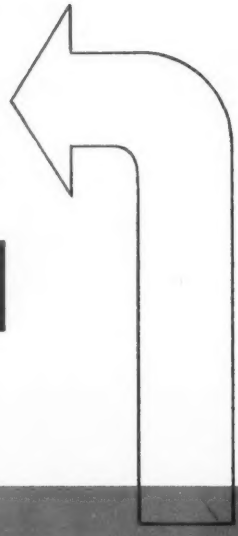

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DENSE SODA ASH

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- *Medium Grain Size*
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Simple, efficient, low-cost equipment for automatically feeding Soda Ash into molten iron for desulfurization is now available. We will be glad to supply detailed information concerning this equipment and its installation upon request.

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Foundry STATISTICS

Malleable Iron

(Shipments of castings—net tons[1])

	Shipments		Unfilled Orders[2]
	Total	For Sale	
1948	933,265	525,212	.....
1949			
Oct.	57,150	28,582	54,322
10 mo.	606,512	316,285	.....
Nov.	49,439	25,250	55,795
Dec.	57,379	29,679	60,835
Total	713,330	371,214	.....
1950			
Jan.	62,874	32,918	62,307
Feb.	60,386	31,249	67,049
Mar.	66,259	38,639	69,866
Apr.	69,822	36,279	76,250
May	76,161	42,432	77,074
June	82,345	46,613	86,783
July	67,514	37,198	105,300
Aug.	86,021	50,019	132,374
Sept.	82,479	46,927	152,583
Oct.	89,968	50,157	160,278
10 mo.	743,829	412,431	.....

Copper-base Alloy

(Shipments of castings—1000 pounds[1])

	Shipments			Unfilled Orders[2]
	Total	Sand	Perm. Mold	
1948	1,030,825	930,790	59,009	.....
1949				
Oct.	58,249	52,861	2,316	23,634
10 mo.	598,538	539,484	31,414	.....
Nov.	61,818	56,669	2,811	23,625
Dec.	63,873	58,291	3,086	23,435
Total	725,318	654,444	37,311	.....
1950				
Jan.	65,585	58,878	3,440	25,216
Feb.	67,029	60,257	3,626	26,923
Mar.	80,442	71,876	4,693	27,631
Apr.	72,318	64,773	3,848	28,769
May	79,108	71,605	3,751	30,880
June	83,023	74,990	3,896	32,808
July	69,033	62,414	3,789	39,906
Aug.	94,013	85,948	4,258	52,513
Sept.	95,641	87,111	4,630	58,673
Oct.	105,746	96,911	5,064	66,560
10 mo.	811,938	734,763	40,995	.....

Aluminum

(Shipments of castings—1000 pounds[1])

	Shipments				Unfilled Orders[2]
	Total	Sand	Perm. Mold	Die	
1948	424,490	139,781	161,334	118,738	.....
1949					
Oct.	29,071	9,634	9,923	8,908	37,881
10 mo.	251,379	87,543	86,879	71,083	.....
Nov.	26,317	9,212	8,315	8,348	36,846
Dec.	26,762	10,070	7,714	8,430	36,921
Total	304,616	106,825	102,908	88,019	.....
1950					
Jan.	28,801	9,646	9,400	9,052	40,591
Feb.	28,887	10,171	9,358	8,851	44,235
Mar.	35,845	13,035	11,094	10,870	47,350
Apr.	33,356	11,091	10,656	10,795	49,952
May	36,031	11,526	11,928	11,799	52,580
June	37,600	12,677	11,825	12,173	53,309
July	30,152	9,613	9,808	9,943	63,892
Aug.	39,852	14,117	12,682	12,207	82,564
Sept.	42,061	14,369	13,085	13,594	89,723
Oct.	47,278	15,994	14,893	15,408	102,938
10 mo.	359,863	122,239	114,729	114,692	.....

Magnesium

(Shipments of castings—1000 pounds[1])

	Shipments		Unfilled Orders[2]
	Total	For Sale	
1948	8,214	7,488	....
1949			
Oct.	796	763	3,050
10 mo.	7,782	7,274	....
Nov.	801	769	2,399
Dec.	781	738	2,216
Total	9,364	8,781	....
1950			
Jan.	814	762	2,237
Feb.	735	676	2,218
Mar.	903	849	2,322
Apr.	799	751	2,305
May	810	762	2,282
June	758	698	2,482
July	727	677	3,356
Aug.	1,147	1,078	4,855
Sept.	1,231	1,154	4,942
Oct.	1,354	1,297	5,573
10 mo.	9,278	8,704	....

Foundry Production Workers

Estimated Number

	Oct. 1950	Sept. 1950	Oct. 1949
Iron & Steel	226,800	221,900	171,600
Nonferrous	89,500	85,400	64,100

Average Weekly Earnings

Gray Iron	$70.76	$68.19	$56.18
Malleable Iron	70.18	68.55	52.32
Steel	69.63	66.00	56.12
Nonferrous	72.29	70.45	62.21

Average Weekly Hours

Gray Iron	44.5	43.6	38.4
Malleable Iron	42.9	42.5	34.4
Steel	42.9	41.3	36.9
Nonferrous	42.8	42.8	39.4

Labor Turnover Rate (Sept.)

(Per 100 employees)

	Total Accession	Total Separation	Quit	Layoff
Gray Iron	8.4	6.7	5.0	0.4
Malleable Iron	9.2	6.2	5.3	0.1
Steel	8.5	4.6	3.6	0.2
Nonferrous	8.9	6.2	4.8	0.5

Source: Bureau of Labor Statistics.

Gray Iron Castings—Shipments

(Net tons[1])

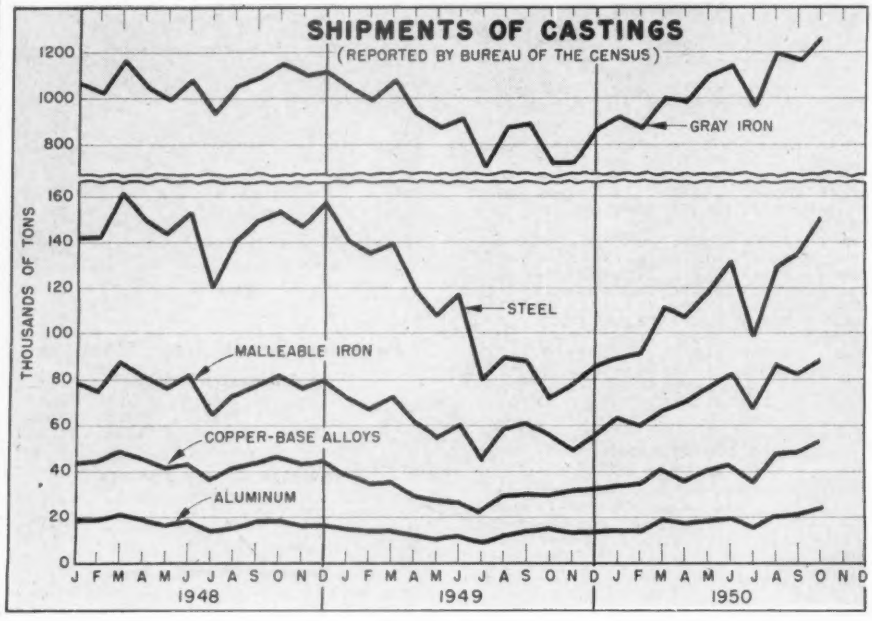
	All Castings		Miscellaneous Castings		Heavy Steel Ingot Molds		Chilled Railroad Car Wheels		Pressure Pipe & Fittings	Soil Pipe & Fittings	Unfilled Orders[2]
	Total	For Sale	Total	For Sale	Total	For Sale	Total	For Sale	Total[3]	Total[3]	Total
1948	12,785,909	7,131,405	8,296,843	3,839,671	1,979,740	865,022	719,784	641,164	1,149,553	639,989	.....
1949											
Oct.	715,685	397,939	539,262	229,570	7,407	4,367	33,762	29,067	79,003	56,251	955,100
10 mo.	8,968,409	4,685,610	5,613,731	2,267,857	1,529,645	645,999	482,791	429,512	892,340	449,902	.....
Nov.	718,703	395,107	489,076	206,795	62,937	26,620	38,006	33,324	71,639	57,045	938,629
Dec.	862,172	440,409	521,613	200,760	183,660	87,241	34,772	30,281	65,764	56,363	892,458
Total	10,549,284	5,517,527	6,624,420	2,675,411	1,776,242	759,860	555,569	493,117	1,029,743	563,310	.....
1950											
Jan.	913,321	449,577	573,743	214,752	188,152	88,244	34,254	29,409	64,095	53,077	914,735
Feb.	864,189	416,594	551,060	201,468	169,605	75,832	33,417	29,187	63,363	46,744	873,455
Mar.	995,782	500,195	635,403	244,122	170,082	71,317	44,898	39,357	89,264	56,135	921,575
Apr.	981,126	483,862	621,368	233,397	182,420	77,923	42,768	37,972	82,774	51,796	922,255
May	1,095,111	572,887	684,632	277,447	195,021	86,016	46,219	40,185	104,529	64,710	977,833
June	1,136,129	613,084	713,811	300,863	197,474	91,377	45,672	41,672	106,980	72,192	1,039,618
July	961,450	507,867	595,918	241,632	177,154	82,363	35,066	30,560	94,438	58,874	1,286,579
Aug.	1,201,569	677,134	747,046	335,868	199,770	92,340	52,508	46,681	131,127	71,118	1,670,380
Sept.	1,159,240	648,966	722,667	325,019	203,191	94,968	44,707	40,304	121,556	67,119	1,794,118
Oct.	1,254,901	700,512	792,764	364,607	220,821	100,082	46,516	41,023	119,105	75,695	1,839,866
10 mo.	10,562,818	5,570,678	6,638,412	2,739,175	1,903,690	860,462	426,025	376,350	977,231	617,460	.....

Steel Castings—Shipments

(Net tons[1])

	All Castings			Carbon Steel			Alloy Steel			Unfilled Orders[2]
	Total	For Sale	Railway Specialties[3]	Total	For Sale	Railway Specialties[3]	Total	For Sale	Railway Specialties[3]	Total
1948	1,760,032	1,335,295	442,258	1,366,913	1,063,027	425,965	393,981	272,374	16,293	.....
1949										
Oct.	71,295	48,263	8,964	53,118	35,163	8,650	17,572	13,100	314	124,817
10 mo.	1,088,607	761,533	216,448	828,736	587,028	207,669	253,821	174,505	8,779	.....
Nov.	76,820	50,685	7,270	54,632	35,221	6,810	21,805	15,464	460	117,865
Dec.	85,033	53,079	9,258	60,864	37,205	8,831	23,644	15,874	427	122,887
Total	1,250,460	865,297	232,976	944,232	659,454	223,310	299,270	205,843	9,666	.....
1950										
Jan.	88,821	57,996	9,298	64,616	41,559	8,607	24,205	16,437	691	142,484
Feb.	91,827	62,045	10,920	66,843	44,473	9,589	24,984	17,572	1,331	165,186
Mar.	111,772	77,588	15,281	82,458	56,492	14,012	29,314	21,096	1,269	185,611
Apr.	106,964	75,133	17,406	79,912	56,008	16,124	27,052	19,125	1,282	201,643
May	117,944	83,845	20,552	88,202	63,658	18,811	29,742	20,187	1,741	198,078
June	131,097	94,637	27,065	96,365	72,427	24,653	34,732	22,210	2,412	206,799
July	98,269	68,874	15,734	70,122	51,204	14,577	28,147	17,670	1,157	255,418
Aug.	128,369	94,413	24,922	92,197	70,721	22,952	36,172	23,692	1,970	329,944
Sept.	134,574	96,738	25,295	98,523	74,052	23,992	36,051	22,686	1,303	427,969
Oct.	149,558	109,660	30,048	112,704	85,157	28,493	36,854	24,503	1,555	521,846
10 mo.	1,159,195	820,929	196,521	851,942	615,751	181,810	307,253	205,178	14,711	.....

[1] Source: Bureau of the Census. [2] All cast iron pipe is shipped for sale. [3] For sale only.



Index of Foundry Equipment Orders

Foundry Trades Only

(Net Orders Closed, New Equipment)

	1949	1950
Jan.	149.9	159.7
Feb.	144.4	113.1
Mar.	190.8	225.2
Apr.	172.0	160.6
May	121.9	294.9
June	164.9	622.7
July	146.6	401.1
Aug.	127.1	693.1
Sept.	166.6	483.1
Oct.	133.5	526.6
Nov.	270.4	...
Dec.	201.0	...

Note: Figures are percentages of the base period 1937-1939 taken as 100 per cent (monthly average). Source: Foundry Equipment Manufactures Association.

Coke Production and Consumption

(Net tons*)

	Production	Consumption Total	Consumption By Foundries
1948	74,861,928	74,214,497	3,750,300
1949			
Oct.	1,735,695	1,553,836	223,698
10 mo.	54,326,515	53,640,543	2,291,249
Nov.	3,504,656	3,618,796	215,299
Dec.	5,617,906	5,903,287	228,203
Total	63,449,077	63,162,626	2,734,751
1950			
Jan.	5,461,719	5,878,562	255,224
Feb.	3,982,336	4,626,521	202,239
Mar.	5,226,489	5,330,772	240,961
Apr.	6,087,079	5,941,701	277,098
May	6,313,632	6,310,454	293,056
June	6,225,024	6,245,877	276,521
July	6,359,566	6,274,054	267,037
Aug.	6,399,936	6,404,004	270,411
Sept.	6,244,285	6,226,380	267,698
Oct.	6,646,249	6,539,684	332,128
10 mo.	58,946,315	59,868,009	2,680,373

Ingot Brass and Bronze

(Shipments in net tons)

	1949	1950
Feb.	15,026	18,487
Mar.	14,550	22,494
Apr.	10,695	22,118
May	11,114	23,643
June	9,696	25,093
July	10,220	21,609
Aug.	14,194	29,689
Sept.	16,208	28,811
Oct.	18,036	32,240
Nov.	18,488	31,748

Source: Ingot Brass and Bronze Industry

Castings Production

In Philadelphia Federal Reserve District

(November, 1950)

Type	Percentage Change From Oct., 1950	Nov., 1949
Gray Iron	— 8.1	+41.1
Malleable Iron	—27.8	+50.6
Steel	—10.7	+22.4
Nonferrous	—17.9	+40.4

Source: University of Pennsylvania.

Iron and Steel Scrap Consumption

(Thousands of gross tons*)

	All Scrap		By Type of Furnace: Cupola		Air		Electric	
	Total	Purchased	Total	Purchased	Total	Purchased	Total	Purchased
1949								
Oct.	1,486	803	641	305	59	19	156	85
10 mo.	41,494	19,259	6,690	3,533	681	236	3,569	2,195
Nov.	3,037	1,434	612	310	53	17	291	180
Dec.	4,750	2,229	666	332	67	23	379	233
Total	49,281	22,922	7,968	4,175	801	276	4,239	2,608
1950								
Jan.	4,906	2,267	699	337	71	25	433	259
Feb.	4,539	2,149	670	315	71	27	417	253
Mar.	5,101	2,430	778	372	87	31	497	296
Apr.	5,119	2,451	766	365	79	29	493	300
May	5,333	2,552	837	416	85	32	539	324
June	5,122	2,483	864	427	92	33	533	317
July	4,708	2,244	669	318	79	28	490	295
Aug.	5,202	2,454	862	426	108	39	568	327
Sept.	5,170	2,468	819	404	109	40	579	348
Oct.	5,643	2,707	866	437	108	40	643	384
10 mo.	50,843	24,205	7,830	3,817	889	324	5,192	3,103

Pig Iron Production and Consumption

	Production** (Standard grades—1000 net tons)					Consumption* (By type of furnace, 1000 gross tons)			
	Total	Foundry	Malleable	Basic	Low Phos. Intermediate Low Phos. & Bessemer	Total	Cupola	Air	Electric
1949									
Oct.	602.3	137.9	99.7	346.6	18.1	672	336	17	3
10 mo.	45,555.3	2,379.7	1,939.2	35,328.9	5,907.4	40,796	3,794	200	78
Nov.	2,687.5	192.5	131.3	2,024.0	339.7	2,476	331	15	5
Dec.	5,166.0	249.7	218.6	3,959.6	738.1	4,656	385	20	13
Total	53,408.7	2,821.9	2,294.5	41,312.5	6,979.8	47,928	4,510	235	96
1950									
Jan.	5,209.0	239.3	226.4	4,033.2	710.1	4,719	421	20	10
Feb.	4,120.1	151.1	187.9	3,239.3	541.8	3,890	396	20	80
Mar.	4,546.8	232.4	201.2	3,554.9	558.3	4,267	448	23	8
Apr.	5,502.8	259.2	229.1	4,298.3	716.2	4,954	449	23	11
May	5,773.6	257.7	223.5	4,572.3	720.1	5,203	474	24	13
June	5,549.3	209.5	257.7	4,393.8	688.3	5,033	494	25	13
July	5,804.2	269.3	282.2	4,561.2	691.5	5,018	403	23	14
Aug.	5,706.2	257.0	284.0	4,407.3	757.9	5,136	516	30	18
Sept.	5,614.6	244.0	257.2	4,380.9	732.5	5,092	500	26	17
Oct.	5,836.8	284.1	260.6	4,541.2	741.0	5,219	466	31	13
10 mo.	53,663.4	2,328.5	2,484.9	41,982.4	6,857.7	48,531	4,567	245	297

* Source: U. S. Dept. of Interior, Bureau of Mines

** Source: American Iron & Steel Institute

NEW IDEAS

For Faster Production - - and Lower Costs

Take For Example —

the 8 gang dump box shown in the unretouched photograph above, measuring 13½ x 9½ x 2½ and weighing only 12 pounds, was made from the single wood master core plug and backing frame. The price, believe it or not, about $36.00.

Also made by the same method are two part split or booked core boxes with flat or irregular partings together with properly cleared white metal master dryer patterns.

There is profit in this idea for you. Hundreds of foundries are now using this modern streamlined method of making core boxes and master dryers because it is accurate, saves machining and offers large savings in the intricate and gang type core box.

Your inquiry will receive prompt attention.

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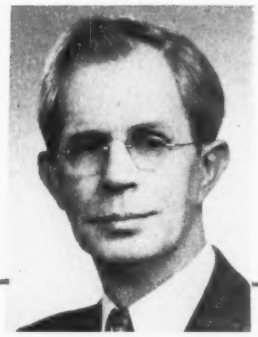
MAN-TO-MAN

on the Molder's Bench

"If We Only . . ."

By RALPH L. LEE



I SUPPOSE that the Lee Hobby Foundry is like most other foundries—in one respect at least—where a good deal of the work is done from day to day under sort of a cloud of thinking what we could do "if we only had'a." If we only had another cupola or furnace, if we only had more room to melt in, more and better flasks and boards, respectable jackets, better sand, better help (Ralph Lee, our molder, is getting to be quite a problem), better bosses, a better layout and more and better customers, we could really go to town.

Of course I realize that a moderate amount of dissatisfaction with things as they are in comparison with what they could be *if* is quite normal and might well turn out to be largely responsible for nagging us on to greater progress. But on the other hand, I have found that when it reaches the point where the edge is taken off of almost everything we do by the ghosts of what we could do "if we only had'a" then this kind of dissatisfaction loses all respectability and becomes nothing more or less than a plain unadulterated alibi for too darned much lead in the britches.

Just before the holidays we had a lot of work up there in the Lee Hobby Foundry, a lot of rush orders from Mother (that's my home superintendent, the vice-president in charge) for Christmas presents.

I had the patterns for these presents, flasks, boards, sand, metal and time. So I started to get ready to make item No. 1. I wet down my sand and started to riddle it through my pet Goldberg power riddle, in which I always throw two cans of round rocks for mulling. As I was shoveling away, my mind wandered off onto what a nuisance it was to have to dump all of those rocks into the riddle, then pick them up, put them back into the cans and hang the cans up on the wall every time I use the riddle.

Still shoveling away, but at a much slower pace, I thought why not build me a little bin on the wall just below where the riddle hangs when not in use? I could put a little trap door in the bottom of the bin, so all I would have to do would be to dump the rocks into the bin as I hang up the riddle. Then as I was taking it down I could put the end under the bin, open up the trap door and presto, there would be all the rocks in the riddle ready to go to work.

Down on my knees, with my steel measuring tape in my hands, it suddenly became evident that the hands of the clock had been whizzing around like crazy while I was inventing and with the sand heap lying there still unriddled. Later it occurred to me that if I were to take the time I lost mooning around over the rock-bin, plus the time I would have taken building the darned thing and getting it to work, and then subtracted the sum from the little smidgen of time I would save on each riddle full of sand, the whole deal would turn out to be well over on the questionable side of the ledger.

Then when I figured the work I could have turned out with all of my mind on what I was doing, it suddenly dawned on me that there truly is a time and place for everything. So I decided to call a moratorium on mind wandering and inventin' at least until my orders were filled.

This experience reminded me of my good friend Dr. Selby, medical director of General Motors for years, who said to me one time, "You know Ralph, I'm not so sure I'm willing to go all the way with that old saying —*never put off till tomorrow what you can do today.*" "What's wrong with it?" I asked.

"Well," he answered, "I can thank my lucky stars in the light of what happened later on any number of occasions that I did put off till the morrow what I could have done on the spot. Somewhere," he added, "in between deliberate procrastination and spur-of-the-moment action is a spot where time alone can save us a lot of wasted effort and regrets."

As a result of chaining up my wandering mind and putting all of it to work on the job I had to do, I found that without changing anything up there in the foundry or getting anything new I really made the fur fly. Piling my boards so they were handy, placing my parting sack within easier reach, clearing off a place for my flask and pattern all paid off in a big way. But the most important thing I am sure was closing the door to all of the cat, rat and dog ideas and suspicions which love to romp around in the old bean distracting me from what I am doing and making me dissatisfied with it.

Making a person's mind behave is quite a chore in anybody's language, but with a darned good thrashing now and then even the most rambunctious imagination can be made to toe the mark. It just struck me that well behaved minds usually belong to folks who get a surprising amount of work done themselves and others along with them.

If I thought for one moment I was discouraging anyone from entertaining new ideas I'd tear this article up right now. All I'm trying to do is to make the point that there truly is a time and place for everything.

The time for work calls for all of what little brains we've got right on the job which can't very well be

(*Concluded on page* 163)

Again...

SIMPSON MIXERS *EXCEED* their rated capacity on HEAVY STEEL FOUNDRY SAND

HERE is another case proving the ability of Simpson Mixers to handle sand batches over and above their rated capacity. This time, it's the Locomotive Finished Materials Company steel foundry — a modern, progressive plant at Atchison, Kansas, where large, heavy steel castings are produced. After a thorough study of their needs, this company installed one No. 3 Simpson Mixer in June, 1950. After just four weeks of mixer operation, they ordered a second, identical Simpson, based on the performance of the first unit.

Results have entirely justified their decision . . . for *3600-lb.* weighed batches are being produced in a 3-minute total mixing cycle, on a 24-hour a day basis, from mixers each having a normal rating of 3000-lbs. per batch . . . and these 20% "over-capacity" batches are being discharged in just 15 seconds — aided by the mixers' large discharge doors.

This is just one example of the way in which dependable, heavy-duty Simpson Mixers are exceeding "normal" performance, even in the hardest service. Be sure you consider the ability of *Simpsons* before you buy *any* mixer. Write for details.

3600 lb. batches being produced 24 hours a day at LOCOMOTIVE FINISHED MATERIALS COMPANY foundry

● The view above shows the two No. 3 Simpson Mixers installed in the Locomotive Finished Materials Co. steel foundry. Both units are equipped with National Cooling Hoods, Moisture Masters and Water Injectors, and are charged with a traveling weigh hopper. Centralized control permits one operator to easily handle both mixers. Normally rated at 3000-lb. capacity, these units are handling 3600-lb. batches, using standard 50-hp motors with no overload problem.

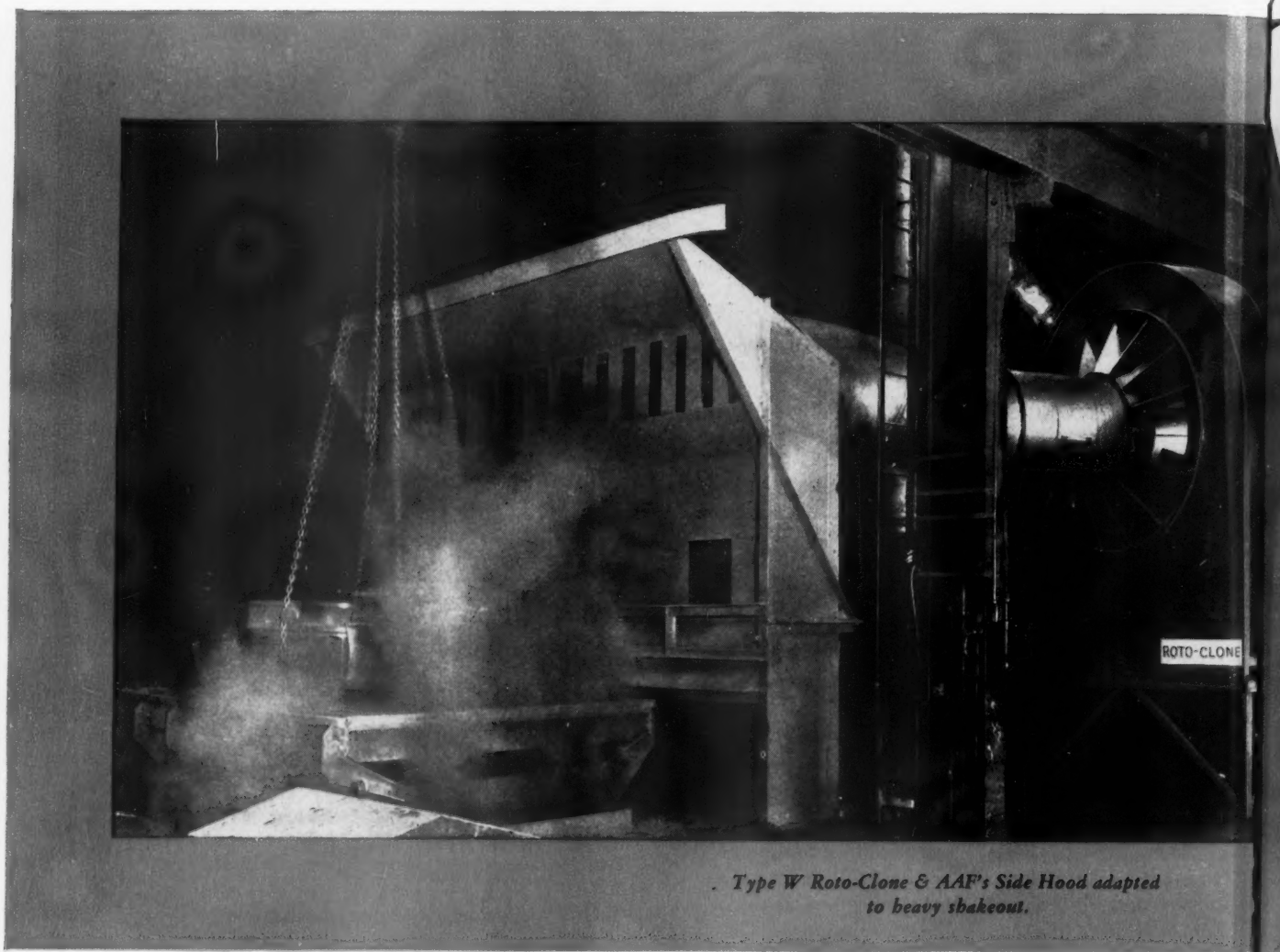
SIMPSON Intensive MIXERS

NATIONAL *Engineering Company*

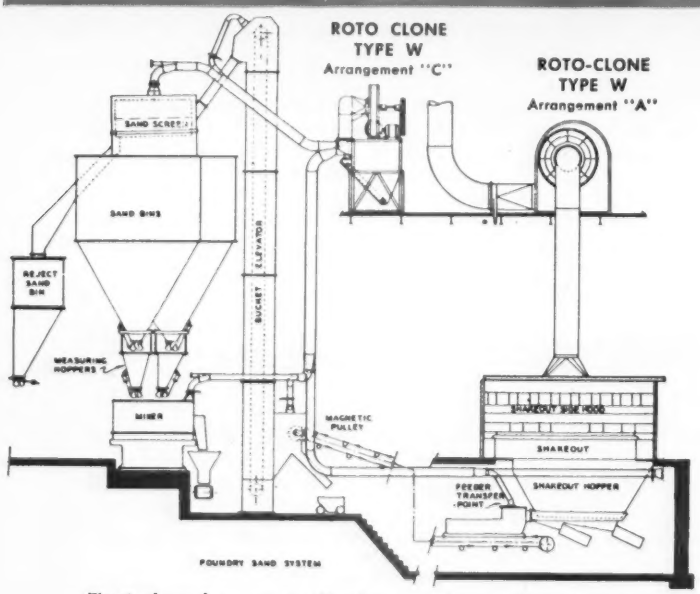
608 Machinery Hall Bldg. • Chicago 6, Illinois

Manufacturers and Selling Agents: For Continental European Countries — George Fisher, Ltd., Schaffhausen, Switzerland; for British Possessions — August's Limited, Halifax, England; for Canada — Dominion Engineering Co., Ltd., Montreal; for Australia and New Zealand — Gibson, Battle & Co., Pty., Ltd., Sydney; for Argentina, Brazil and Uruguay — Equipamentos Industriais EISA Ltda., Sao Paulo, Brazil; for Mexico — CASCO, S. De R.L., Mexico, D.F.

eliminate dust and fumes.



. Type W Roto-Clone & AAF's Side Hood adapted to heavy shakeout.



Typical sand system applications of Type W Roto-Clone.

As the metal industries flex their muscles for another—and greater test, efficient production assumes new importance. AAF Roto-Clone air filtration not only saves man-hours and cuts maintenance costs but provides other economies. For one example Type W Roto-Clone applications to foundry sand systems help maintain effective sand characteristics for molding.

The complete line of AAF Roto-Clones offers a wide selection of performance and operating characteristics to meet practically every dust control need. For the correct solution to your dust or air pollution problems call your nearby AAF representative or write direct to:

es. for PEAK PRODUCTION

Today's Best Buy is Better Air!

Type W Roto-Clone arrangement C with precleaner hopper and automatic sludge ejector.

AAF ROTO-CLONES

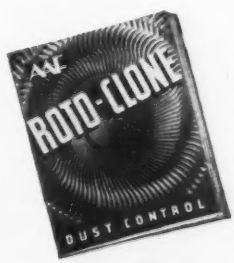
increase production . . . save man-hours . . . cut maintenance costs!

Dust and noxious fumes impair both mechanical and human efficiency. Foundry shakeout and sand conditioning operations are two sources for these "spoilers" that are tough to control. However, AAF Type W Roto-Clone* dynamic precipitators, designed and engineered specifically for this problem, have proven their high efficiency in thousands of dust control installations. Consider these performance characteristics of Type W Roto-Clone:

- High efficiency in collecting both coarse particles and extreme fines in excessive concentrations.
- Continuous operation at peak efficiency without interruption for reconditioning or service.
- Maintains constant exhaust air volumes for correct conveying velocities.
- Combines dynamic precipitation with wet collection to dispose of secondary dust and disposal problems.
- Low installation and operating costs.
- Compact, self contained design requires minimum space—there's always room for a Roto-Clone.
- Large number of sizes affords great flexibility for any exhaust requirements.

*ROTO-CLONE, is the trade-mark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.

Write for AAF's Engineering Bulletin #270



AAF American Air Filter
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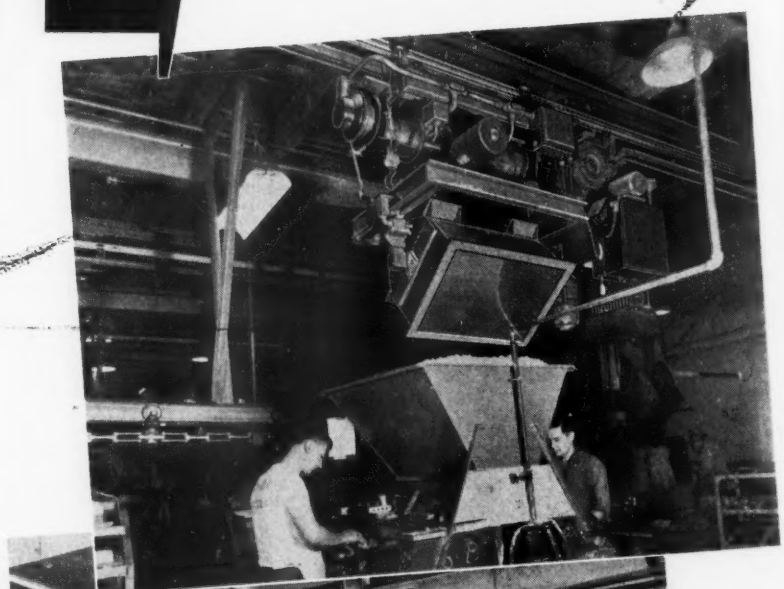
WITH **Present Plant Manpower**

Present Plant Space



The next time you walk through your plant, cast your eyes toward the ceiling and you'll realize that there is mighty valuable space that can be put to work—without increasing your plant capacities and without increasing plant manpower.

An American MonoRail engineer will show you how you can use your "air rights". With thousands of overhead handling installations from which to draw, each with many money and time saving advantages, it will pay you to investigate American MonoRail Overhead Handling Systems. Send for bulletin C-1.

THE AMERICAN MONORAIL COMPANY

13104 ATHENS AVENUE CLEVELAND 7, OHIO

(*Concluded from page* 158)

done while fumin' and frettin' around on what we could do *if* we only had'a. Most of us haven't really learned how to use what we've already got.

Oh! by the way, after I got my production out (no scrap to speak of) I found by nailing a little strip over one end of my power riddle, I could hang it up on the wall without taking the rocks out at all, which made me think that Dr. Selby really did have a point.

Issues Welding Standard

"Safety in Electric and Gas Welding and Cutting Operations" (American Standard Z49. 1-1950) covers regulations for the safe installation and operation of welding equipment for all arc, gas and resistance welding processes. Provisions are included for fire prevention and protection, protection of personnel, ventilation requirements, and precautions are specified for the welding of materials which may give off toxic fumes and for welding in confined spaces.

Book Review

Casting and Forming Processes in Manufacturing, by James S. Campbell Jr., cloth, 536 pages, 6 x 9¼-in., published by the McGraw-Hill Book Co., New York. Price, $5.

For a number of years the foundry industry has needed a text for college level students which would deal with the fundamental principles of casting production. Now, within the past year, two excellent texts have appeared, the present work having been prepared by Professor Campbell of the Mechanical Engineering Department, Rensselaer Polytechnic Institute, Troy, N. Y.

While this text covers most of the processes for forming metals and plastics, it is interesting to note that the author has devoted 358 pages to sand, permanent mold, centrifugal and die casting production, and the remaining 148 pages to all of the remaining processes, including plastics, powder metallurgy, rolling forging, sheet metal working and punch press work.

Scope of the work can best be seen by the following chapter headings: Making a simple mold; patternmaking; molding materials and equipment; molding techniques; types of molds and materials used; making larger molds; solidification and risering; gating; sand testing; pattern equipment, molding machines; cores and coremaking; forces within molds; metals; melting; cleaning and finishing; organization; modernization; mechanization; defects; inspection; design; centrifugal casting; precision investment casting; permanent mold casting; die castings. The text is exceptionally well illustrated.

The author is to be congratulated on producing a text that should prove of great value, both to the engineering student and the young man in the foundry industry.

WISCONSIN FOUNDRY CONFERENCE

Planned for Feb. 8-9

PROGRAM for the 14th annual Wisconsin Regional Foundry Conference includes over 20 technical sessions to be devoted to discussion of a wide range of topics. The conference, to be held Feb. 8-9 at Hotel Schroeder, Milwaukee, is being sponsored by the Wisconsin Chapter of the American Foundrymen's Society and the University of Wisconsin.

George E. Tisdale, Zenith Foundry Co., is chairman of the conference, with Joe G. Risney, Risney Foundry Equipment Co., serving as co-chairman, and Prof. E. R. Shorey and Prof. George Barker of the University of Wisconsin, associate chairmen.

Speakers at the opening general session Thursday morning, Feb. 8, will include Dean M. O. Withey of the university and Walton L. Woody, national AFS president. Sectional meetings to be held Thursday afternoon and Friday morning and afternoon will cover subjects relating to steel, gray iron, malleable iron, nonferrous metals and patterns.

Program for the conference follows. Speakers for the luncheons will be announced later.

Thursday Feb. 8

9 a.m.—Registration

10-11:50 a.m.—*Opening Address,* Dean M. O. Withey, University of Wisconsin; W. L. Woody, National President, AFS

12 noon—*Luncheon Meeting*

2:15-3:45 p.m.—

Steel: "Gates and Risers," by J. B. Caine, metallurgist, Wyoming, O.

Gray Iron: "Cupola Operation with High Scrap Mixture," by A. J. Busch, Chas. C. Kawin Co.

Malleable Iron: "High Speed Grinding in the Malleable Foundry," by A. S. Rakestraw, Norton Co.

Nonferrous: "What's Wrong in Your Cleaning Room?" by B. H. Work, Carborundum Co., and representatives of Vapor Blast Co. and Master Pneumatic Tool Co.

Pattern: "Patterns Required for the Cronin[illegible] Process," by J. Klement, Ampco Metal Inc.

4-5:40 p.m.—

Steel: "Metal Penetration in Steel Castings," by S. L. Gertsman, Department of Mines & Technical Surveys, Ottawa, Ont.

Gray Iron: "Fluidity Testing of Gray Iron Castings," by Prof. P. C. Rosenthal, University of Wisconsin

Malleable Iron: "Dielectric Core Baking," by Allis-Chalmers Mfg. Co. representative

Nonferrous: "Mechanization of the Small Jobbing Foundry," by L. G. Probst, National Engineering Co.

Pattern: Foundryman's Attitude toward Pattern Equipment," by G. P. Antonic, Motor Castings Co.

6:30 p.m.—*Banquet:* Speaker to be announced

Friday, Feb. 9

10-11:50 a.m.—

Steel: "Riser Compounds," by Prof. H. F. Taylor, Massachusetts Institute of Technology

Gray Iron: "Scrap Castings Due to Sand Defects," by George Anselman, Beloit Foundry Co.

Malleable Iron: "Do You Believe Your Molding Sand Can Affect Your Casting Shrinkage?" by C. A. Sanders, American Colloid Co.

Nonferrous: "Faster and More Efficient Melting," by J. G. Winget, Reda Pump Co.

Pattern: "Value of Patternmaking to Modern Casting Engineering," by J. Anderes, Belle City Malleable Iron Co.

12 noon—*Luncheon Meeting*

2:30-4 p.m.—

Steel: "Repair Welding of Steel Castings," by J. D. Wozny, American Steel Casting Co.

Gray Iron: "The Modern Foundry—Design, Operation and Maintenance," by E. E. Ballard, Lester B. Knight & Associates Inc.

Malleable Iron: "Malleable Annealing," by Prof. Richard Schneidewind, University of Michigan

Nonferrous: "Exothermic Riser Compound" by James O'Keeffe, Jr., Exomet, Inc.

Pattern: "Demonstration Drag and Cope Dual Production," by A. F. Pfeiffer, Allis-Chalmers Mfg. Co.

Partial view of the Wisconsin Regional Foundry Conference committee. Left to right are: Don Gerlinger, Gerlinger Equipment Inc.; E. C. Maegher, Federal Foundry Supply Co.; W. W. Edens, Badger Brass & Aluminum Co.; Al Pfeiffer, Allis-Chalmers Mfg. Co.; G. E. Tisdale, Zenith Foundry Co., chairman; Leon Decker, Allis-Chalmers Mfg. Co., and Prof. E. R. Shorey, Universiy of Wisconsin. Other committee members not shown are: J. G. Risney, Risney Foundry & Equipment Co., co-chairman; Prof. G. J. Barker, University of Wisconsin; D. E. Stephens, H. Kramer & Co.; R. G. Rice, Milwaukee Chaplet & Mfg. Co.; Frank Jacobs, Standard Brass Works, and Harold Boehm, Allis-Chalmers Mfg. Co.
Photo by courtesy of Walter V. Napp, Badger Firebrick & Supply Co.

Activities of Foundry

GROUPS

Connecticut Non-Ferrous

MEMBERS of the Connecticut Nonferrous Foundrymen's Association enjoyed a skit presented by the boys from Charles Parker Co., as a prelude at a serious consideration of time study in the foundry at the Nov. 15 meeting held at Castle Restaurant, New Haven, Conn. The first act, entitled "How Not To Set Rates in the Foundry," satirized the burden of excessive overhead, the ineptness of hit-or-miss pricing and the folly of allowing workmen to set their own rates. Act II, "Time Study Strikes the Trout Casting Co.," signaled the advent of a young industrial engineer who, after considerable opposition from the old timers, brought about a reformation in cost and evaluation methods to put the foundry on a profitable basis.

The symposium on industrial engineering in the foundry was presented by L. E. Harkness, R. B. Beisel, Louis Bailey and William Heim of Aluminum Co. of America.

Mr. Beisel spoke first on measurement evaluation and methods for determining the standard time for a job. Mr. Harkness spoke next on estimating and pricing. Given standard operational data such as outlined by Mr. Beisel, plus an accurate figure of overhead, it should be possible to arrive at a fair idea of costs on a job.

Job evaluation was then considered by Mr. Bailey. Improper job rates cause trouble in the foundry while proper rates have the opposite effect. In setting up rates three points have to be considered: The prevailing community rates; present company policy, high low or average pay; and past practice.

In conclusion, William Heim spoke on wage incentives. Properly used, a wage incentive plan is a valuable tool for controlling costs as well as rewarding employees and works for maximum production. A wage incentive plan is not a cure-all, but is the best system for keeping costs down, guaranteeing good production and rewarding the better workers.—*John V. McCarthy*

Northwestern Pennsylvania

REGULAR meeting of Northwestern Pennsylvania Chapter of the AFS was held Nov. 27, at the Moose Club, Erie, Pa. R. A. Colton, research metallurgist, American Smelting & Refining Co., Barber, N. J., was guest speaker on the subject, "Problems in Casting Bronze."

Mr. Colton described in detail the manufacture of various alloyed metals of the bronze family, giving his theory of the various causes for defects such as gas, shrinks and blow holes. Douglas James, Cooper-Bessemer Corp., Grove City, Pa., and chapter vice chairman, presided at the meeting in the absence because of illness of Frank Volgstadt, chairman. William Piper, Erie Bronze Co., Erie, was discussion leader.

Bailey Herrington, Hickman, Williams & Co., and chairman of the chapter's membership committee, has inaugurated a novel program and gratifying progress is being made in reaching the chapter's goal of 50 new members. The chapter also is cooperating in the apprentice program to train new molders since there is a shortage of foundry help in the district.—*Earl Strick, Erie Malleable Iron Co.*

Central Illinois

FIFTH annual Christmas party of Central Illinois Chapter of AFS was arranged for members, their ladies and guests and was held Dec. 9 at the American Legion Hall, Peoria, Ill., with 350 in attendance.

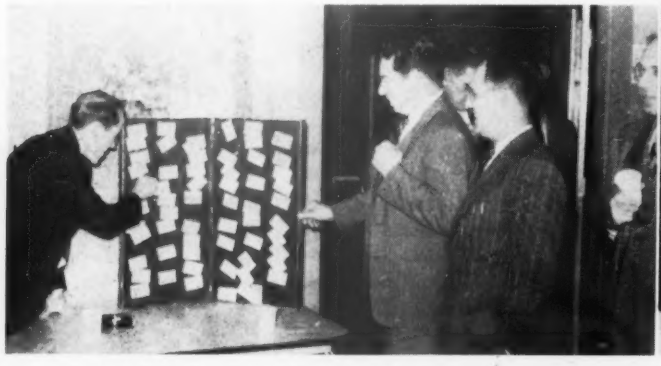
All enjoyed a turkey dinner, and gifts were given to the ladies. Entertainment consisted of dinner music followed by a stage show—*Robert Paluska, Caterpillar Tractor Co.*

Western New York

NODULAR iron was discussed at the Dec. 1 meeting of Western New York Chapter of the AFS. Joseph M. Clifford, superintendent, Bison Castings Inc., Buffalo, was the speaker.

Mr. Clifford first presented slides showing various types of castings poured with nodular iron. These included pressure and machine work. The illustrations showed gating and risering setups together with the kind of sand used on the various jobs. Hardness tested specimens from 4 to 5 in. illustrated the uniformity of the metal in heavy areas, indicating nodular iron's suitability for pressure work. Other illustrations presented the effects of magnesium on the base

(*Continued on page* 166)



TRI-STATE Chapter, AFS, held its Nov. 17 meeting at Poohlahna Hill Country Club, Tulsa, Okla. At left, chapter members select identification badges. At right, a discussion group gathers around Howard Wilder, Vanadium Corp. of America, guest speaker. Photos by F. E. Fogg, Acme Foundry & Machine Co.

As executives Morton and Proud of Anstice agree . . . Malleabrasive gets castings completely clean and at low cost!

AT THE ANSTICE COMPANY ROCHESTER, N.Y.

MALLEABRASIVE®* SAVES

SHOT and GRIT

$3016.00 a year ON BLAST CLEANING

Here's why Malleabrasive saves you money

MALLEABRASIVE . . .

- is designed for modern cleaning equipment
- wears out fewer machine parts
- lasts 2 to 4 times longer
- reduces machine down-time
- reduces cleaning costs up to 50%
- increases output of cleaned castings

PLACE A TEST ORDER TODAY!

ONCE again, an impartial test by the customer *proves* Malleabrasive saves money. As Ken Proud, Foundry Manager at Anstice says: "We tested Malleabrasive against regular grit for 150 hours on miscellaneous castings."

And here are the results: *"With Malleabrasive we used 52.6% less grit and cut replacement parts cost by 43.8%. On the basis of a 40-hour week this means Malleabrasive saves us $3016.00 a year!"*

Malleabrasive is the *original* long-life abrasive pioneered by the Globe Steel Abrasive Co., Mansfield, Ohio. Pangborn invites you to test Malleabrasive. See for yourself Malleabrasive lasts 2 to 4 times longer . . . and cuts cleaning costs up to 50%!

SEND FOR FREE TEST KIT

Contains all necessary forms to run a comparative test to give savings in time, money, and labor. For your free test kit write Pangborn today. Address your letter to: PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the Latest Developments in Blast Cleaning and Dust Control Equipment.

Pangborn

*U. S. Patent #2184926 (other patents pending)

BLAST CLEANS CHEAPER with the right equipment for every job

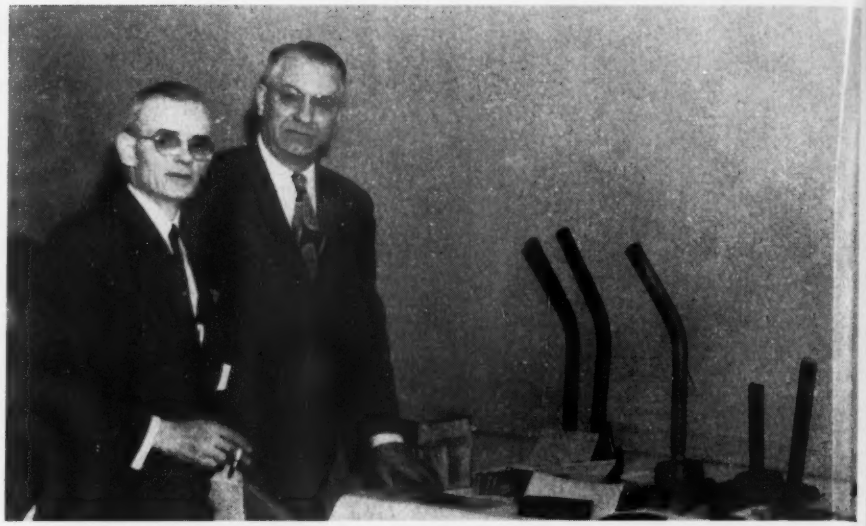
(*Continued from page* 164)

metal treated and how final silicon inoculation affects structure composition in the as-cast condition.

Mr. Clifford also included slides showing structure of the metal as cast and annealed and gave the physical properties of both. The speaker emphasized the importance of base and final chemical compositions of the metal and the necessity of having a sufficiently high temperature, 2800 to 2900° F, at the time of tapping. Included in the presentation were reproducibility graphs showing consistency from heat to heat and ladle to ladle as related to chemical composition and physical properties together with comparison graphs of chemical and physical properties of medium carbon irons, 3.50 to 3.60 per cent, and high levels of 3.75 to 3.90 per cent carbon nodular heats as cast.

Robert K. Glass, assistant chief metallurgist, Buffalo Works, Republic Steel Corp., and technical chairman of the meeting, pointed out in conclusion that there are 70 foundries in the United States and 30 foundries in Europe producing nodular iron in cupolas, and that Bison Castings Inc., is the only foundry producing that metal in an electric furnace.

Among the guests present were: Ronald C. Timms, Welland Iron & Brass Co., Welland, Ont.; M. T. Ganzauge, General Railway Signal Co., Rochester, N. Y.; James Ochsner, Edward Fiesinger and J. F. Livingston of Crouse-Hinds Co., Syracuse, N. Y.—*Marve Taublieb, Frederic B. Stevens Inc.*



WESTERN NEW YORK Chapter of the AFS heard Joseph M. Clifford (left), Bison Castings Inc., Buffalo, speak on "Nodular Iron" at its Dec. 1 meeting. At right is Lloyd Wright, U. S. Radiator Co., Geneva, N. Y. Nodular iron test bars are shown on the table. Photo by Marve Taublieb, Frederic B. Stevens Inc.

CINCINNATI DISTRICT Chapter of the AFS held its annual Christmas party Dec. 16 at Netherland Plaza Hotel, Cincinnati. At left are William Gilbert Jr., Buckeye Foundry Co., Cincinnati, entertainment chairman, and Marian Spellman, mistress of ceremonies. General view of the party is shown below

Acme Photos

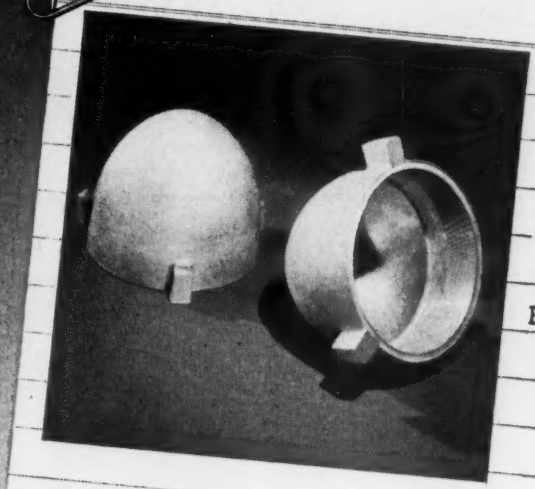
Cincinnati

APPROXIMATELY 500 members and their ladies enjoyed the Christmas party of Cincinnati District Chapter of the AFS, held at the Netherland Plaza Hotel, Cincinnati, Dec. 16. Each lady was presented a multicolored silk scarf.

During dinner two accordian playing strolling musicians played Christmas songs and answered requests which induced considerable communi-

(*Continued on page* 169)

What's the right X-Ray film?



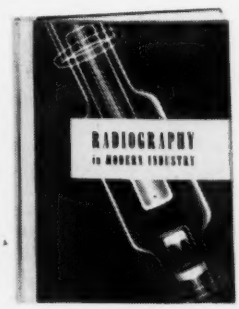
Product:
Drill press housing
Material:
Aluminum alloy—¼" thick
Equipment:
X-ray machine, 140 KV.

ANSWER:

KODAK INDUSTRIAL X-RAY FILM, TYPE A

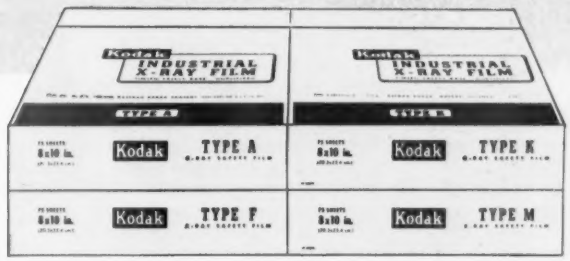
Hours of machining time were involved—so it was important that these housings be sound—that no irregularity should wait to be revealed by the cutting tools. In a matter of minutes, radiography checked for defects.

The radiographer chose Kodak Industrial X-ray Film, Type A, because this film has enough speed to keep exposures reasonably short even at low voltages. Its high contrast and fine graininess are also valuable in taking full advantage of higher kilovoltage machines in detecting irregularities in thick or dense materials.



RADIOGRAPHY IN MODERN INDUSTRY

A wealth of invaluable data on radiographic principles, practice, and technics. Profusely illustrated with photographs, colorful drawings, diagrams, and charts. Get your copy from your local x-ray dealer—price, $3.



A TYPE OF FILM FOR EVERY PROBLEM

To provide the recording medium best suited to any combination of radiographic factors, Kodak produces four types of industrial x-ray film. They also provide the means to check welds efficiently and thus extend the use of the welding process.

Type A—has high contrast with time-saving speed for study of light alloys at low voltage and for examining heavy parts at high kv. Used direct or with lead-foil screens.

Type M—provides maximum radiographic sensitivity for direct exposure or with lead-foil screens. It has extra-fine grain and, though speed is less than Type A, it is adequate for light alloys at average kilovoltage and for much million-volt work.

Type F—provides the highest available speed and contrast when exposed with calcium tungstate intensifying screens. Has wide latitude with either x-rays or gamma rays, exposed directly or with lead screens.

Type K—has medium contrast with high speed. Designed for gamma ray and x-ray work where highest possible speed is needed at available kilovoltage without use of calcium tungstate screens.

EASTMAN KODAK COMPANY
X-ray Division · Rochester 4, N.Y.

Radiography...

another important function of photography

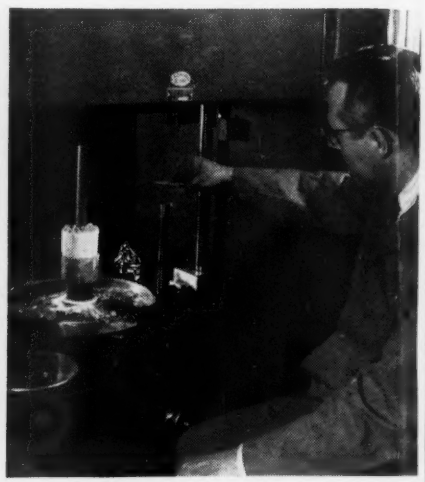
Kodak
TRADE-MARK

MEXICAN CORDIP®—ANOTHER NEW PRODUCT DEVELOPED BY THE UNITED STATES GRAPHITE COMPANY

NEW HIGH TEMPERATURE WASH GIVES SMOOTHER, TRUER CASTINGS

Mexican Cordip is just one of the many new products that are continually being developed by the research facilities of The United States Graphite Company. Mexican Cordip is a high temperature coating that gives castings maximum surface smoothness. Dry or green cores maintain true dimensions because Mexican Cordip *will not build up or run on core surfaces.* It penetrates sand to an effective depth to prevent burn-in. Since its development in the laboratories, Mexican Cordip has proven its worth in daily use in some of America's finest foundries. Mexican Cordip is supplied in powdered form complete with binder and is *easy to prepare and use* either as a spray or dip. Other grades of Mexican Graphite foundry facings are available to suit your particular casting operations.

Small cupola used to simulate actual pouring conditions at The United States Graphite Company laboratory.



1⅛" cores with small cylindrical cavity being charged with metal (left) for insertion into the hot zone of the Dilatometer (right). Metal melts to form a small pellet. After cooling, the core and casting are studied for ease of removal, coating remaining, burn-in, and surface appearance.

MODERN LABORATORY DUPLICATES ACTUAL FOUNDRY CONDITIONS FOR BETTER PRODUCT RESEARCH

Old-time foundry men and newly graduated metallurgists alike who have visited The United States Graphite Company's neat, new foundry research laboratories in Saginaw have been enthusiastic about the completeness of the equipment, *the thoroughness of the tests*—and the extent to which the engineers here are going in order to develop even better Mexican Graphite products for America's foundries.

In this amazingly complete laboratory is a perfect little 4½" diameter cupola that exactly duplicates the results of its big brothers on production. An electric furnace and a Dilatometer are used to study the effect of temperatures up to 3000° F under just about any atmosphere. Metallurgical microscopes are used for closer study (up to 3,000 diameters) of the sand-metal interface of experimental cores and molds.

There is a core oven and complete sand testing equipment so that precise studies can be made of the penetration, effect on surface, and physical characteristic of sand when using various types of Mexican Graphite washes.

Within this modern laboratory there is even a chemical laboratory *fully equipped for making every kind of test and analysis* that is likely to apply to foundry products and foundry practice.

It is largely because of the completeness of this modern laboratory—and the skill, knowledge and creative ability of the engineers here that United States Graphite Company products are so effectively saving production time, cutting costs and helping to assure better castings in America's leading foundries today. *This laboratory is at your service.* Call or write us.

154

THE UNITED STATES GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN

(*Continued from page* 166)

ty singing. Following dinner, a five-act floor show was presented followed by dancing.—*B. A. Genthe, S. Obermayer Co.*

Eastern New York

THIRD annual stag Christmas party of Eastern New York Chapter of the AFS was held Dec. 19 at Circle Inn, Lathams, N. Y. R. N. Williams, who headed the committee in charge of the affair, had arranged an evening which included excellent food, and entertainment appropriate for a stag night. In addition some very nice door prizes were distributed.

Chapter Chairman Leo Scully, Scully Foundry & Machine Co., Coxsackie, N. Y., expressed the thanks of the chapter to the suppliers who made the party possible. L. D. Wright, U. S. Radiator Co., Geneva, N. Y., a national director of the AFS, was present and gave a short talk on membership. Those present signed cards for Roy Garrison and Jasper Wheeler, chapter members who were unable to attend because of illness.—*George E. Danner, American Locomotive Co.*

Eastern Canada

A DISCUSSSION on the reclamation of foundry sands was presented by Clyde B. Jenni, metallurgist, General Steel Castings Corp., Eddystone, Pa., at the Dec. 8 meeting of Eastern Canada Chapter of the AFS. The meeting was held at Mount Royal Hotel, Montreal, with L. Guilmette, Canada Foundry Supplies & Equipment Co. Ltd., Montreal, and chapter chairman, presiding. Mr. Jenni, as chairman of the Philadelphia Chapter, brought greetings from that chapter and carried with him reciprocal greetings from the Montreal group.

Mr. Jenni described means currently in use for partial and complete reclamation of used sands. The least expensive and that having very limited effect is merely removing excess fines with an air stream. This removes little burnt-out binder from the sand, either inorganic or organic. The wet scrubbing process removes adhering inorganic binders such as clay but is ineffective in removing most carbonaceous residues left by core oils, cereals and resins.

The speaker favored a combined process of wet scrubbing followed by a firing process to eliminate both types of impurities. Slides of the sand grains in the new condition, after wet scrubbing and after the combined wet and fired reclamation showed that the latter method restored completely the original lustrous appearance of the quartz grains, the end product being distinguishable from the new sand only by a slightly yellower appearance. The fully reclaimed sand is used exactly as new sand with regard to quantity of binders added.

(*Continued on page* 172)

EASTERN CANADA Chapter of the AFS conducted a problem casting forum Nov. 17 at New Sherbrooke Hotel, Sherbrooke, Que. The board of experts, all of Quebec, who led the discussion are, left to right: Leonard Bradley, Canadian Ingersoll-Rand Co., Sherbrooke; Wilfrid Legare, La Fonderie Legare, Sherbrooke; James Clark, Canada Iron Foundries, Three Rivers; James Grieve, Dominion Engineering Works Ltd.; Turney Shute, Canadian Car & Foundry Co., Steel Casting Division, Montreal; Henri Louette, Warden King Ltd., Montreal; William Birks, Crane Ltd., Montreal, and Lucien Guilmette, Canadian Foundry Supplies & Equipment Ltd., Montreal, and chairman of Eastern Canada Chapter

WESTERN MICHIGAN Chapter of the AFS devoted part of its Dec. 4 meeting to a discussion of the principles of industrial exhaust systems. Three engineers who presented a demonstration on that subject are shown at top. Left to right, are: K. E. Robinson, ventilation engineer; G. E. Tubich, and R. S. McClintock, district engineers, Division of Industrial Health, Michigan Department of Health. Lower view is a scene from the chapter Christmas party held Dec. 15 at Spring Lake Country Club, Spring Lake, Mich. Photos are by courtesy of Frank Beetham, Campbell, Wyant & Cannon Foundry Co.

TODAY'S ANSWER TO SAND MULLING PROBLEMS

THE COREMAKER'S ANSWER . . . better—more flowable—non-sticking sand.

THE MOLDER'S ANSWER . . . stronger—more flowable—fluffier—more uniform sand.

THE MAINTENANCE FOREMAN'S ANSWER . . . more sand—less maintenance—no down time.

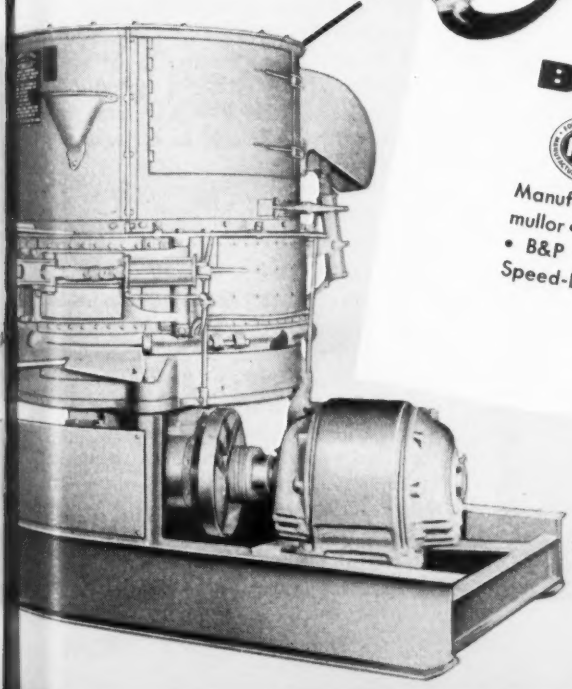
THE SAND TECHNICIAN'S ANSWER . . . more uniform sand of maximum physical properties—minimum material additions.

THE CLEANING ROOM'S ANSWER . . . finer surface finish—easier cleaning.

THE FOUNDRY SUPERINTENDENT'S ANSWER . . . higher uninterrupted production—lowest operating costs.

TOP MANAGEMENT'S ANSWER . . . lowest initi cost—lowest operating and maintenance cost—lowest material cost per ton—and complete dependability.

the SPEEDMULLOR



B&P

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Division of **PETTIBONE MULLIKEN CORPORATION**

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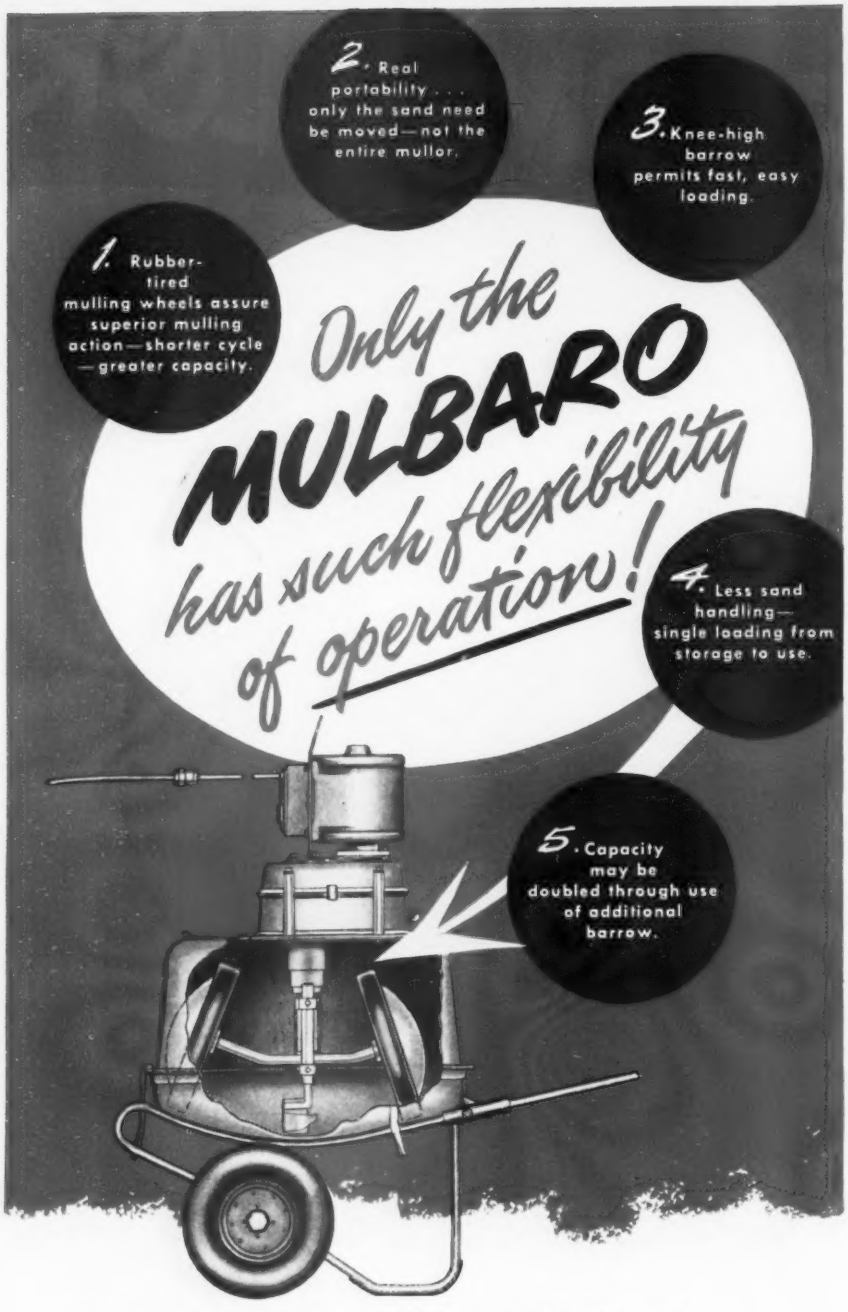
Manufacturers of the Sandslinger • Speedslinger • Hydra-Slinger • Speed-mullor • Mulbaro • Screenarator • Nite-Gang • Junior Nite-Gang • Preparator • B&P Combination Sand Conditioning and Mulling Unit • B&P Champion Speed-Draw • B&P Plate Feeder • B&P Turntable • B&P Gyratory Screen


2. Real portability . . . only the sand need be moved—not the entire mullor.
3. Knee-high barrow permits fast, easy loading.
1. Rubber-tired mulling wheels assure superior mulling action—shorter cycle—greater capacity.
Only the MULBARO has such flexibility of operation!
4. Less sand handling—single loading from storage to use.
5. Capacity may be doubled through use of additional barrow.

If you want *thorough* mulling, *minimum* sand handling and *real* portability at *lowest* initial and operating cost . . . then the Mulbaro is the answer! The Mulbaro is used for many different applications in large or small foundries—for core, facing and molding sand or for special batches of ladle lining or cupola patching material. Several barrows may be used alternately, thus providing the capacity of two or more mullors for slightly more than the cost of one. Write today for complete information on the Mulbaro.

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MEMBER FEMA

(*Continued from page* 169)

Mr. Jenni, while suggesting that there are many types and combinations of equipment layouts suitable for the purpose, showed and described a schematic flow sheet of the process favored by General Steel Castings. Most of the equipment included, while not specifically designed for foundry operation, is commercially available as commonly used mine and smelter equipment.

The system described is capable of reclaiming upwards of 100 tons of sand in 24 hours at a cost the speaker estimates is about 50 per cent that of new sand delivered to the plant. The process, he pointed out, is most rewarding for steel foundries, but in modified form could be considered favorably by other type foundries operating with a synthetic sand based on straight silica.

An interesting discussion period was conducted by E. C. Winsborrow, Shawinigan Foundries, Ltd., acting as technical chairman. Turney Shute, Canadian Car & Foundry Co. Ltd., expressed the chapter's thanks to Mr. Jenni.—*A. E. Cartwright, Crane Ltd.*

New Jersey

Hermann P. Good, foundry manager, Textile Machine Works, Reading, Pa., discussed a trip he made last fall to England and Germany before the New Jersey Foundrymen's Association at its regular monthly meeting, Nov. 20, at the Military Park Hotel, Newark, N.J.

He had made the trip at the invitation of the English Foundry Council to address its annual conference, and after the conference was taken on a personally conducted tour of visits to several British foundries. He also went to Germany to inspect a new type of hot blast cupola.

Mr. Good discussed the relative efficiency of British and American gray iron foundries, commenting on some of the more interesting techniques he saw, and also spoke on the activities of the British foundry associations.

Twin City

CHRISTMAS party of Twin City Chapter of the AFS was held at Hotel Nicollet, Minneapolis, Dec. 14, with 300 members and guests present.

Harriet with her accordion accompanied group singing during the fellowship period after which a delicious smorgasbord dinner was served. Dinner music was provided by Ferd Oldre and his orchestra. The entertainment program included acrobatic dancing, violin music by Gloria Burkhardt—Miss Minnesota of 1950—and magic by Bud Jacobson, who was also mas-

ter of ceremonies. The evening was concluded with a drawing for many valuable gifts and the presentation of $100 cash or the equivalent merchandise to the Lutheran Receiving Home as a gift from the chapter.

Credit is due Lloyd King, King Foundry, and his committee for the excellent Christmas party. — *J. D. Johnson, Archer-Daniels-Midland Co.*

Tennessee

PRINCIPAL speaker at the Oct. 27 meeting of Tennessee Chapter of the AFS was Earl E. Woodliff, Detroit, who spoke on "Molding and Core Sand Control through Binder Selection." Meeting was held at Hotel Patten with 60 members and guests present. Paul Arnold, U. S. Pipe & Foundry Co., Chattanooga, and chapter chairman, presided, and Porter Warner Jr., Porter Warner Industries, and vice chairman of the chapter, was in charge of the program.

Mr. Woodliff stated that sand testing, as it is often practiced, would be of greater value if less testing was done and more control exercised. He said he did not mean to be critical of sand testing, for it is a definitely needed foundry control, but sand testing provides its greatest benefits when the men given this responsibility are of an analytical mind and make concentrated effort to forestall trouble before it fully materializes.

Control starts with the selection, ordering and testing of new sand. Mr. Woodliff suggested that sand be selected by its clay content, permeability, and grain distribution. For silica sand, grain distribution is important and most foundrymen do not pay enough attention to that factor. By controlling sand grain size it is possible to secure a smooth casting with minimum trouble from buckles, blows and metal penetration. Mr. Woodliff recommended a greater grain spread for eliminating scabs, blows and other defects.

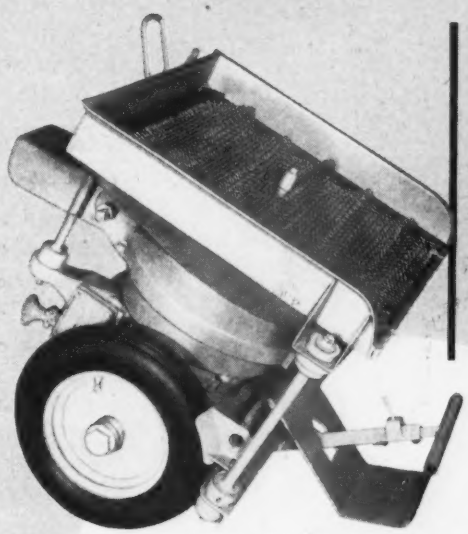
Amount of clay desired in natural molding sand will vary depending on work. On large work, which tends to burn the clay back faster, clay content may be specified up to 25 or 30 per cent. For lighter sections and smaller work, clay content may be specified at 20 to 23 per cent. If clay balls form, an occasional addition of core sand may be added to compensate for the lack of clay burning out by the metal.

According to the speaker, Tennessee sands as a class are among the best found in the country, but they have two characteristics which should be taken into consideration, namely:

(*Continued on page* 175)

NOW...MORE THAN EVER

the Lowest Cost sand conditioner!



Improved features of design and construction make the Screenarator—now, more than ever—the lowest cost sand conditioner! The Screenarator is lowest in original cost and lowest in maintenance cost per ton of sand thoroughly conditioned. Its simple, tested design and rugged construction assure trouble-free performance. Thousands of Screenarators in foundries throughout the world have proved to be unbeatable sand conditioning investments.

THE SCREENARATOR

Three Screenarator models with capacities of 20 to 45 tons per hour produce *thoroughly* screened, *twice* aerated, lump free, fluffy, flowable sand. All types of sand are prepared with the same thoroughness and economy. Both jobbing and production foundries find that the Screenarator pays for itself in a short time. Write today for a Screenarator bulletin!

1. Move it to any foundry floor

2. Plug into a power outlet

3. Screen, double aerate and discharge the sand

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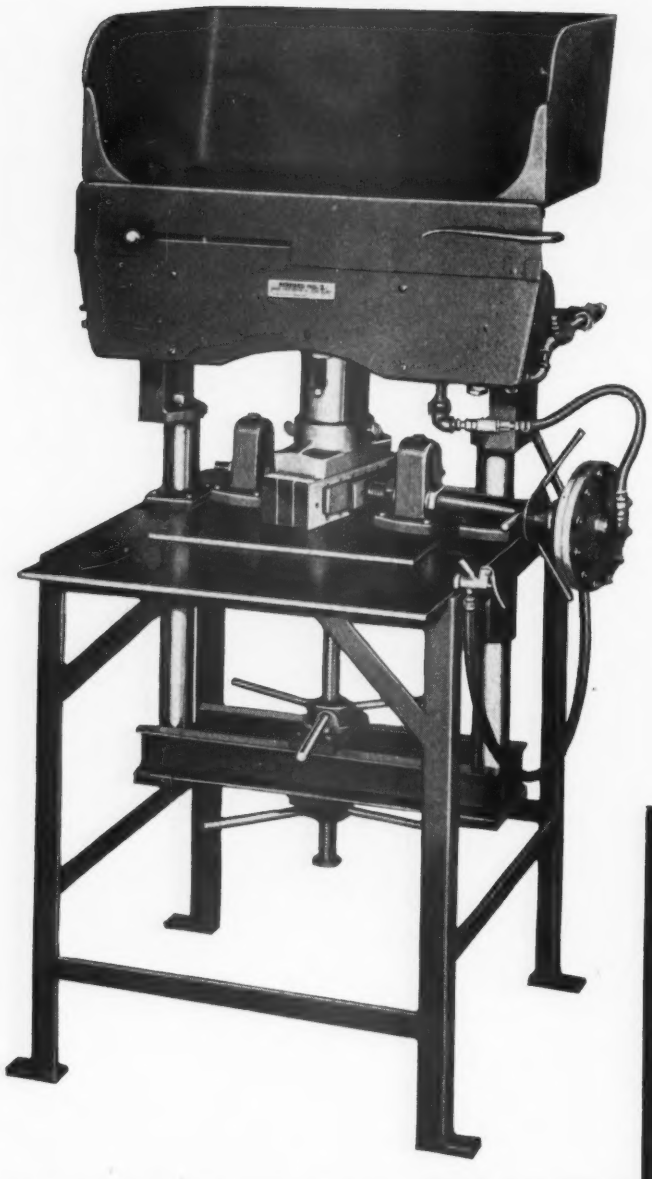
B&P

FEMA

Redford CORE BLOWERS



REDFORD NO. 2 STATIONARY MAGAZINE TYPE CORE BLOWER . . . . .

New standards are being set with this machine, because every motion of your operator has been correctly evaluated to obtain a maximum of production with a minimum of effort.

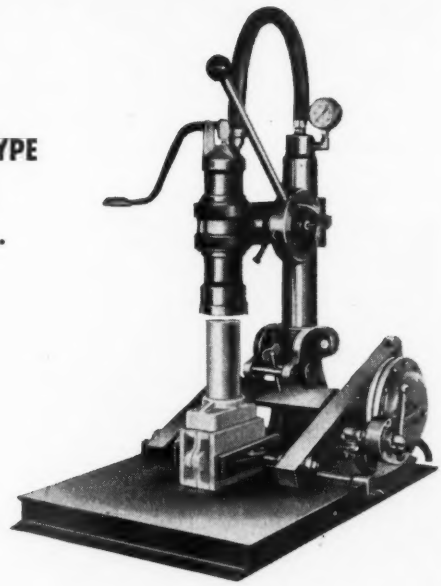
8 OUTSTANDING FEATURES:

1. Large stationary work area.
2. Large sand supply hopper.
3. Stationary sand magazine.
4. Easy accurate locating of core boxes.
5. Quick change magazine heads.
6. Quick adjustment for different height core boxes.
7. Quick change, fully adjustable, vertical clamping attachment.
8. Actuating one handle clamps the core box, blows the core and releases the core box, in two seconds.

CAPACITY: Cores up to 5#

Write for Specification Bulletin "F"

REDFORD CARTRIDGE TYPE BENCH CORE BLOWER . . . . .



The original small core blower . . Proven simplicity, speed and flexibility. Makes cores up to 2#.

Thousands in use in American Foundries . .

Write for Specification Bulletin "G"

Redford IRON & EQUIPMENT CO.

PHONE: KEnwood 1-8611

20733 GLENDALE AVENUE • DETROIT 23, MICHIGAN

(*Continued from page* 173)

A clay content that tends to burn out rather rapidly; and a high silica content having a high thermal expansion which results in buckles and rattails. For successful use of most Tennessee sands, some organic mineral should be used to stabilize them.

The chapter sponsored a Dietert Sand School at Kirkman Vocational High School, Chattanooga, Nov. 6 through 8, with more than 70 members participating.—*Carl A. Fischer Jr., Fischer Supply Co.*

Southern California

MORE than 400 members and guests of Southern California Chapter of the AFS were present at the Lakewood Country Club, Long Beach, Calif., Nov. 13 for the chapter's annual Christmas party. The following committee members did a fine job in arranging the party: O. J. Stoudt, Brumley-Donaldson Co., chairman; William C. Baud, Mechanical Foundries Div.; James A. Olive, Olive Supply Co.; John Hyatt, Grant Co.; Morris Gittleman, Pacific Cast Iron Pipe & Fitting Co.; Earl Tibbetts, Los Angeles Steel Casting Co.; Otto Rosentreter, Foundry Engineering; Ray D. Dorcey, Quality Foundry Co.; John W. Janca, Dayton Foundry; Stanley W. Brand, Snyder Foundry Supply Co.; Clinton Cook, General Metals Corp., Dominic Troncale, Alum-Brass Foundry; Charles F. Tingler, Independent Foundry Supply. —*S. L. Jackson, Electro Metallurgical Division*

Chicago

THE well-founded belief of the Chicago Chapter, AFS, that roundtable type meetings attract better attendance than general meetings was mildly upset Dec. 4. Showing of the colored motion picture, "Fluid Flow in Transparent Molds—II," brought out 221 members and guests, as compared with 190 for the group sessions the month before. The reason, of course, was the widespread interest in the research findings incorporated in the film.

Chapter President Chester V. Nass, vice president, Pettibone Mulliken Corp., conducted the general portion of the dinner meeting at the Chicago Bar Association. He said success of the sand course conducted in November was most gratifying. Actual registration was 220 and average attendance 180 for the four sessions on consecutive days.

Now being considered, Mr. Nass revealed, is a cupola course of about the same length for possible scheduling in April following the foundry practice and demonstration course Jan. 8—Apr. 9. (For announcement of demonstration course, see p. 166, FOUNDRY, January.)

Walter W. Moore, superintendent, Burnside Steel Foundry Co., and chapter vice president and program committee chairman, introduced S. C. Massari, technical secretary, AFS,

SOUTHERN CALIFORNIA Chapter of the AFS at its Nov. 10 meeting raffled off a television set. Raffle proceeds were donated to the AFS new building fund. At left, left to right, are: Earl Appleman, Calmo Engineering Co., and Gail Adair, who drew the winning ticket held by Anthony Tuzzolino, Overton Foundry. At right is Tom Barlow, Eastern Clay Products Inc., Jackson, O., guest speaker. Photos by courtesy of K. F. Sheckler, Calmo Engineering Co.

METROPOLITAN Chapter of the AFS held its Christmas party at the Essex House, Newark, N. J., Dec. 8, with over 500 attending. Photos above supplied through courtesy of John Bing, Metropolitan Refractories Corp.

the SANDMASTER provides the finest-conditioned sand that money can buy

MAGNETICALLY SEPARATES SCREENS

CUTS THE SAND WITH A MULLING ACTION

AERATES AND COOLS

UNIFORMLY BLENDS NEW SAND WITH OLD PILES

PERMITS RECUTTING UNTIL PROPER TEMPERATURE IS OBTAINED

CONDITIONS SYNTHETIC SANDS QUICKLY AND WITH LESS BOND ADDITION

The extra-thorough cutting, mulling and screening action of the new Sandmaster give sand a "Velvet-Feel" that makes molding easier and reduces casting rejects. There is no other portable sand conditioning unit that conditions the sand so thoroughly. The Sandmaster removes all tramp metal by magnetic separation. Other foreign particles are removed in the screening process which fluffs, aerates and cools the sand, leaving it in prime condition.

Yes, the Sandmaster gives you the finest conditioned sand that money can buy. And at the same time reduces your sand conditioning costs, improves the quality of castings and cuts scrap losses to negligible proportions.

In fact, at the Zenith Foundry Company, Mr. W. R. Tanner, President, estimates the decreased scrap losses alone will pay for the Sandmaster in several years' time.

It will pay you to investigate the new Sandmaster. Airmail your request today for Bulletin No. 45.

SAND CONDITIONING HEADQUARTERS FOR OVER 43 YEARS

SANDMASTER American

WHEELABRATOR & EQUIPMENT CORPORATION

505 S. Byrkit St., Mishawaka 2, Indiana

who prefaced and showed the film. The latter explained that the film was part of a progress report which the AFS Aluminum and Magnesium Research Committee presented this year on the research project it has had under way for the past 3½ years. A black and white film was shown to the chapter last year. The new sound and color film represents about 1½ years of work and includes the results of more recent investigation. An extensive question-and-answer period followed showing of the film.

Four roundtables provided the program for the Jan. 9 meeting of the Chicago Chapter. Approximately 175 attended.

Chapter President Nass announced that 215 members of the chapter were enrolled at the first session of the Foundry Demonstration Course consisting of seven sessions. He stated also that chapter officers will determine the interest for a Melting course of 15-20 hours which might be offered after conclusion of the Demonstration course. Mr. Nass asked for support of the annual Ladies Night party to be held at the Palmer House, Feb. 3

Steel and Pattern Divisions combined to discuss "Standardization of Casting Practice" with A. S. Grot, plant metallurgist, Edward Valves Inc., East Chicago, Ind., as speaker. Clyde Wyman, chief metallurgist, Burnside Steel Foundry Co., was chairman.

Gray Iron Division heard Oscar Blohm, vice president and chief metallurgist, Curto-Ligonier Foundry Co., Ligonier, Ind., discuss "Cores for the Jobbing Foundry." Karl Blom, superintendent, Lindgren Foundry Co., Batavia, Ill., was chairman.

Malleable Division conducted a clinic on "Headaches in the Foundry and Core Departments with Del Sherman, assistant general superintendent, malleable foundry, McCormick Works, International Harvester Co., as "Chief Surgeon." Consulting staff consisted of "Doctors" Kenney P. Smith, general foundry foreman, Chicago Malleable Castings Co.; Gene Kiningham, assistant foundry superintendent, Illinois Malleable Iron Co.; Paul Skirha, foundry foreman, Crane Co.; Ed Jory, foundry engineer, National Malleable & Steel Castings Co.; Joe DeHulsters, core foreman, Moline Malleable Iron Co., St. Charles, Ill.; and Burke Lanham, sand control, William E. Pratt Mfg. Co., Joliet, Ill.

"Melting Vehicles and Materials for Aluminum Alloys" was the topic discussed by the Nonferrous Division

with W. C. Shirley, chief metallurgist, United States Reduction Co., East Chicago, Ind., as speaker, and Fred L. Riddell, foundry metallurgist, H. Kramer & Co., as chairman. —*Erle F. Ross.*

Philadelphia

FOUR hundred members and guests were present at the annual Christmas party of Philadelphia Chapter of the AFS. The party was held at the Benjamin Franklin Hotel. Featured were a turkey dinner and an excellent floor show.—*G. H. Bradshaw, Philadelphia Naval Shipyard*

Wisconsin

ANNUAL Christmas party of Wisconsin Chapter of the AFS was held at the Crystal Ballroom, Hotel Schroeder, Milwaukee, Dec. 8. A real Christmas dinner with all the trimmings was served together with plenty of holiday cheer, music and entertainment. As usual, a capacity crowd of 700 members and guests was attracted to the affair at which business talk and technical discussions were taboo.

The following committee in charge of arrangements included: Kellie Johnson, Carpenter Bros, Inc., chairman; M. C. Frankard, Delta Mfg. Co., co-chairman; John Janes, Standard Foundry Co., Racine, Wis.; Harold Ziebell, Crucible Steel Foundry; William Thompson, Milwaukee Chaplet & Mfg. Co.; Carl F. Haertel, Falk Corp.; Harry Arneson, Spring City Pattern Works, Waukesha, Wis.; Lucian G. Osborne, Lakeside Malleable Castings Co., Racine.—*John E. Hubel*

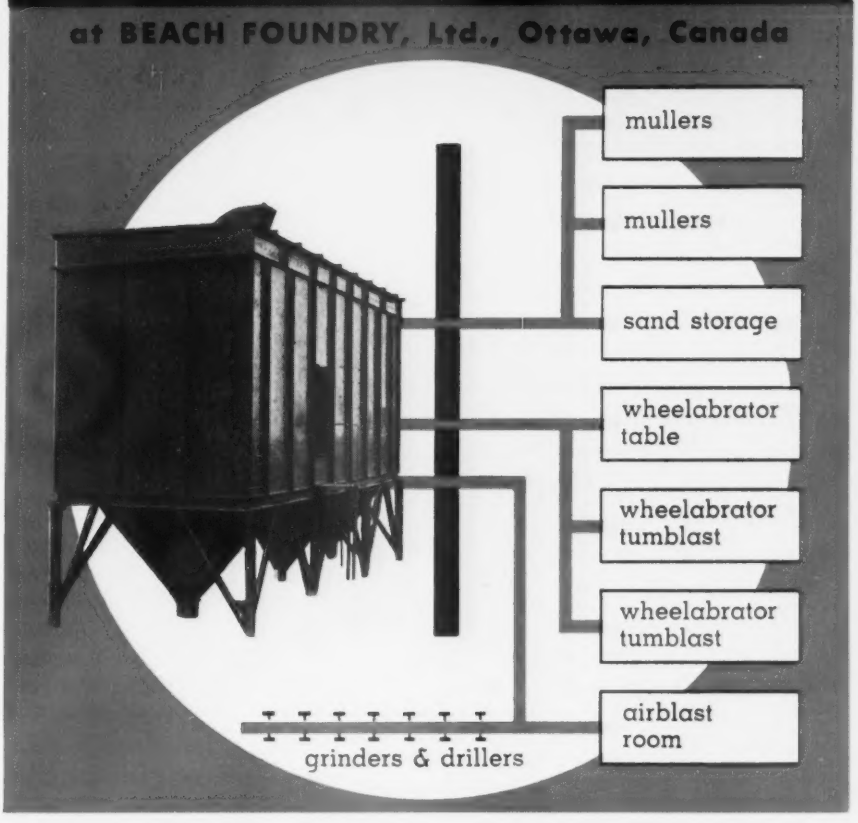
Western Michigan

A NEW high attendance mark featured the Dec. 4 meeting of Western Michigan Chapter of the AFS held at Cottage Inn, Muskegon, Mich. Following a smorgasbord and barbecued spareribs dinner, the 129 members and guests present were shown a demonstration of "The Principles of Industrial Exhaust Systems" by K. E. Robinson, ventilation engineer, R. S. McClintock, district engineer and G. E. Tubich, district engineer of the Division of Industrial Health, Michigan Department of Health. The demonstration was made effective through the use of miniature hoods, blowers, etc.

The AFS research film, "Fluid Flow," produced by the Aluminum and Magnesium Research Committee in conjunction with Battelle Memorial Institute, was viewed with consider-

DUSTUBE ventilates 8 foundry operations

at BEACH FOUNDRY, Ltd., Ottawa, Canada



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able enthusiasm. In conclusion, several films on hunting and fishing were presented.

Eighth annual Christmas party and ladies night was held at Spring Lake Country Club, Spring Lake, Mich., with more than 200 members and their ladies present. Cocktails were served at 6 p.m. and the evening continued with dinner, a floor show and dancing until 1 a.m. Favors were given to the ladies present.—*C. H. Cousineau, Carpenter Bros. Inc.*

TIMBERLINE Chapter of the AFS met at the Oxford Hotel, Denver, Nov. 13. Shown at the speakers' table, left to right, are: T. Norman, Climax Molybdenum Co., technical chairman; Howard H. Wilder, Iron Foundry Division, Vanadium Corp. of America, Detroit, speaker; John W. Horner Jr., Slack-Horner Brass Co., Denver, chapter chairman; Thomas W. Widener, American Manganese Steel Division, American Brake Shoe Co., chapter treasurer; James Schmuck, Rotary Steel Casting Co., Denver, chapter secretary, and Jerry Lahr, chapter director

Northern California

PRACTICAL Aspects of Non-Destructive Testing" was the title of Northern California Chapter of the AFS Dec. 8 program. The meeting was held at Hotel Shattuck, Berkeley, Calif.

The subject was discussed by a panel of chapter members who, with the use of slides, showed the 97 members and guests present how x-rays or gamma rays and magnaflux can be used as a foundry inspection tool to insure casting soundness. Ed Carter discussed magnaflux inspection and costs; Bill Wolff, problem casting in gray iron; Jack Watson and Dick Nelson, problem casting in steel; and Phil McCaffery, theory. Bob Johnston, who was to discuss interpretation of films, was unable to carry on his speaking assignment due to an attack of laryngitis. An interesting highlight of the meeting was the showing of gating and risering methods as first used on castings together with the changes found necessary through radiographic examination.

The meeting was also designated Father and Son Night and nine fathers were introduced with their sons and sons-in-law who have followed in the foundry industry.—*J. M. Snyder, Jos. Musto Sons-Keenan Co.*

Lone Star Steel Co., Dallas, Tex., on Dec. 4 dedicated its $1,500,000 cast iron pressure pipe foundry and tar-chemical plant at Lone Star, Tex. First sections of pipe produced by the foundry were delivered to officials of Hughes Springs and Daingerfield, Tex., who had ordered the pipe prior to construction of the foundry.

NORTHERN CALIFORNIA Chapter of the AFS devoted its December meeting to a discussion of nondestructive testing methods and to honoring fathers and sons in the foundry industry. At left discussing x-ray of castings prior to the chapter meeting are, left to right: Dick Nelson, Pacific Steel Casting Co., Berkeley, Calif.; Bill Wolff, Bob Johnston, Phil McCaffery, and Jack Watson, General Metals Corp., Metals Division; and Ed Carter, Vulcan Steel Foundry Co., Oakland, Calif. Below is a group of fathers and their sons at the meeting

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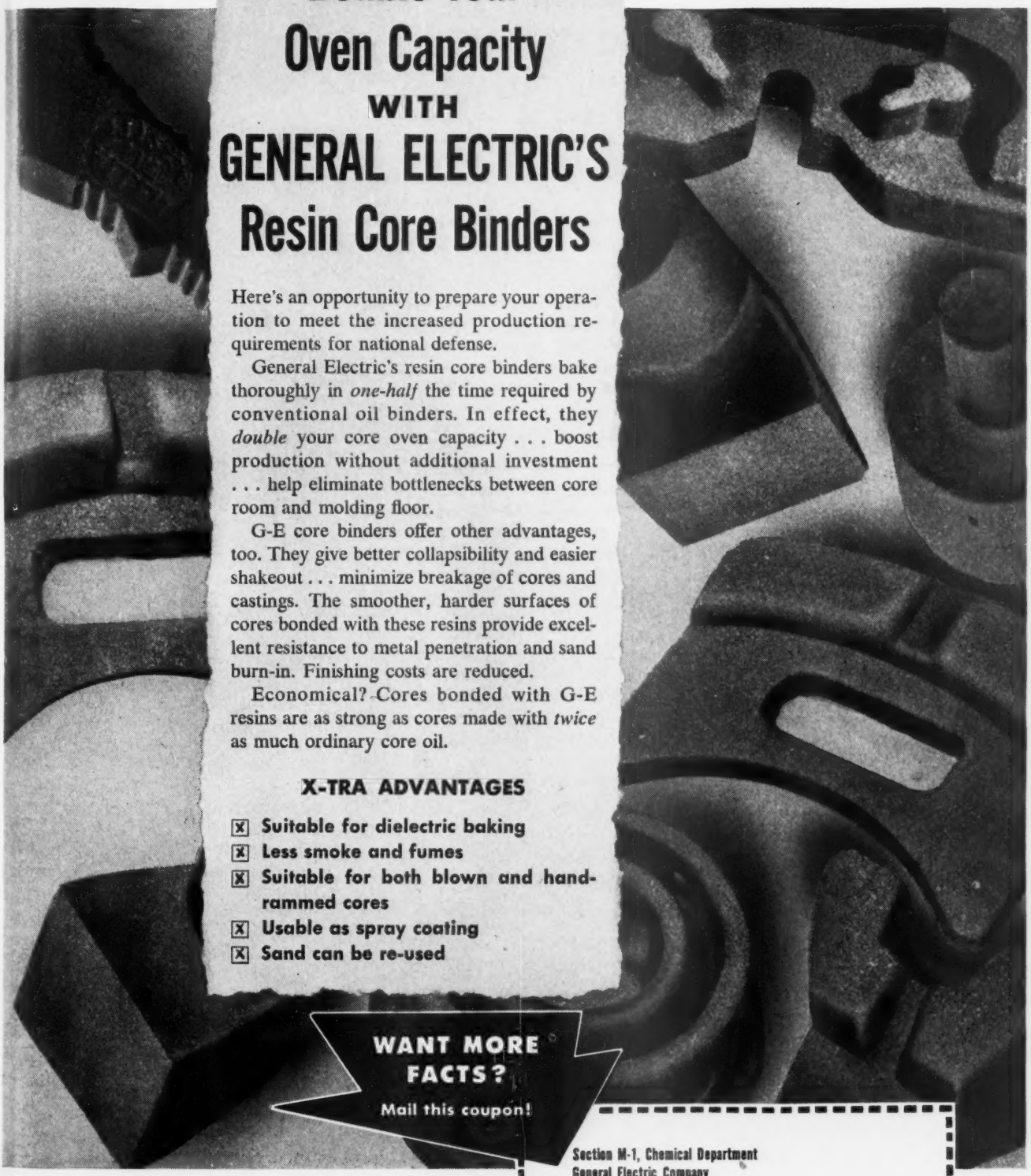

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Methods of Gating Sand Molds

ABC of Foundry Practice

By PAT DWYER, *Engineering Editor, FOUNDRY*

ON MANY large heavy castings the distance molten metal must travel from the gate is minimized by providing gate entrances at two or more levels in the mold. The sprue extends to the bottom and the first metal enters at or near the bottom of the mold. Additional gates supply molten metal at successive stages as the metal rises in the mold. This is in accordance with theoretical good practice which suggests that the hottest metal be in the top part of the casting. Since feeding takes place through gravity the casting should be poured in a manner that will promote progressive solidification from the bottom toward the top.

In a typical example of this kind—a large gas engine cylinder—the runner basin shown in Fig. 1 supplies metal to two upright sprues made of 4-in. tile built into the brickwork diametrically opposite each other and extending to the bottom of the mold. Two flat gates, 1½ x 5 in., at the bottom of each sprue conduct the first metal into the lower part of the mold. These gates are set at a tangent to impart a whirling motion to the metal and thus keep in motion any dross or other foreign material present. The second runner basin delivers the metal to a ring of small pop gates surrounding the center or barrel core. Metal is poured simultaneously from two ladles, with the exception that a cushion of metal from the bottom gates is allowed to accumulate before the metal commences to stream in through the ring of pop gates on top.

Many gate combinations are employed to exclude foreign material from the mold. In the simplest form two sprues are connected by a passage at the bottom. Metal flows down the first sprue, flows across the channel to where the second sprue offers a lodging place for slag or other foreign material floating on top. The clean metal flows from the bottom of the second sprue, through a suitable gate into the mold. Usually the gate passage is at right angles to the passage connecting the sprues. Practically without exception the connecting passage is formed in the cope, while the gate is in the drag. Variations of this type of gate include a curved passage which imparts a whirling motion to the metal; a bar or baffle; a strainer core and a horn gate. The particular advantage of this type of gate is that foreign material floating on top of the metal, through lower specific gravity floats to the top of the metal column in the second sprue, while the clean metal flows into the mold. To maintain a column of metal in the second sprue and thus secure the advantage of the gate, it is essential that both sprues be kept full until the mold is filled.

In practically all types of skimmer and strainer gates and runners advantage is taken of: 1. The difference in specific gravity between molten iron and foreign inclusions, and 2. The attraction of cohesion which holds foreign material in contact with the cold sand in the mold or core or both.

Each time molten iron enters a narrow or constricted passage and then is allowed to expand in a comparatively large chamber, some of the foreign material separates from the iron and adheres to the chamber wall. This feature is taken advantage of in many types of pouring basins where the metal passes through more or less complicated passages. In another style runner favored by many foundrymen the plain basin on top of the cope holds a constant supply of metal which drops through any desired number of pencil gates formed

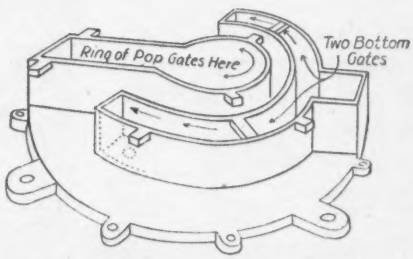

Fig. 1—Layout of runner boxes for large gas engine cylinder

in rectangular dry sand cores. These cores are placed directly on the pattern and rammed up with the cope as shown in Fig. 2. These cores contain no reinforcing rods, are made in standard lengths and are kept in stock. They readily may be cut to fit any depth of cope.

On many castings a single sprue is sufficient, while on others two or more may be required. Obviously, where metal is poured into a mold simultaneously from two or more ladles, the mold will fill more rapidly than where only one ladle is employed. For thin castings, speed of pouring is the most important factor to be considered. Molten metal may and does remain liquid for a comparatively long period in a thick, heavy casting. Limiting factors—character of the sand in the cope, a chill face, or low temperature—may dictate the advisability of pouring a heavy casting as rapidly as possible. Usually in a case of this kind a variation of pouring speed is not reflected in the appearance of the casting.

On many light castings the entire success of the molding process depends on the speed with which the metal enters the mold. Unless it is driven in hard and fast through generous gate openings, the metal will not fill the mold completely. High velocity is required to carry it to its destination before solidification sets in.

In this connection it is interesting to note that no risers are employed on molds where rapid pouring is practiced most widely—that is, in stove plate foundries. This would seem to indicate a flaw in the theory held by one school of foundrymen, that unless a definite exit is provided for the air in the mold, the iron will not fill the mold properly. This theory might hold with a mold of some material impervious to air, but it lacks plausibility when applied to a material as open and porous as the sand in a green or dry sand mold.

Actual observation should prove that air can escape through sand from any mold, much more rapidly than metal can fill the same mold. At no time is the air under compression. The once popular theory that air in a mold is compressed to a point where it helps to support the sand in the cope, is not borne out in any well made mold. Internal commotion in a mold, whether caused by gas or steam, will cause the air to blow with more or less force through the riser or risers. Clapping a cover on the riser will conceal the evidence of what is going on inside the mold, but the extra volume of gas and steam will escape through the sand walls. In extreme instances the pressure may be developed to a point that

(*Continued on page* 182)

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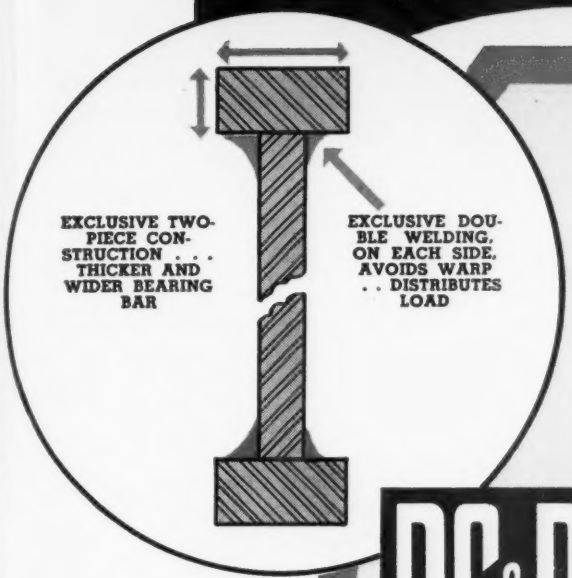
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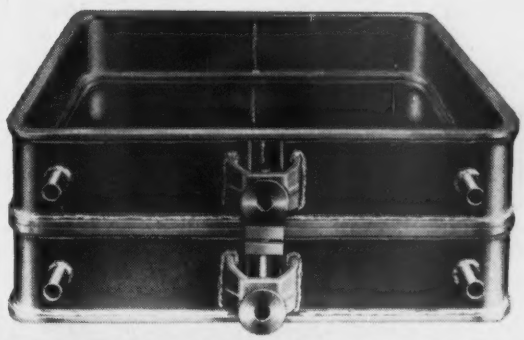

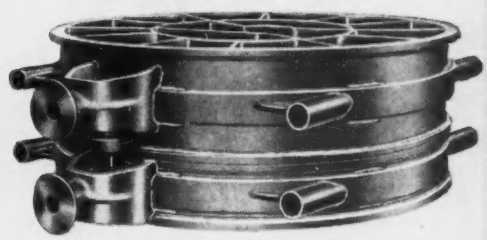

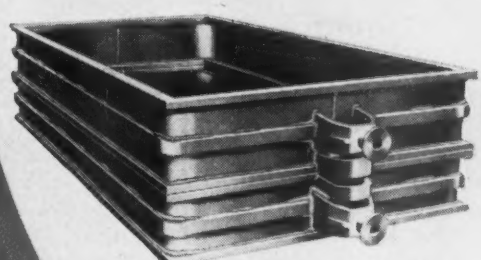

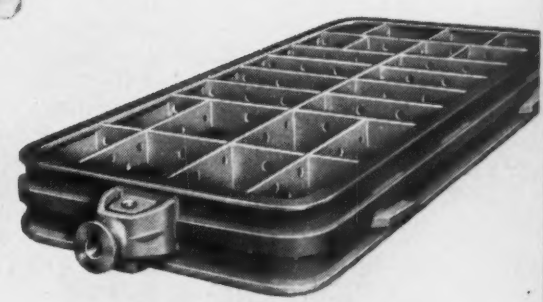

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(*Continued from page* 180)

will raise the cover on the riser, but that simply is evidence of a defective mold. On molds prepared properly, the metal flows into the mold cavity and up into the riser without creating any rush of air through the riser.

Tradition and custom play a more important part than common sense in many foundries. In most cases no riser is required on a casting. In instances where a riser is needed as a show-up, flow-off or feeder, no necessity exists for a cover. An ordinary mold that can be poured readily when equipped with a riser, may be poured just as readily without a riser. A mold that will kick and boil under an open riser, will kick and boil just as violently under a covered riser.

Exception to the foregoing may be noted occasionally in deep, narrow flanges in the cope. In this instance a whistler is employed. The term "whistler" is applied to a species of small riser and is based on the noise made by the rapid escape of air through a small orifice. In some instances the term is applied to any small riser, but in the majority of instances the term is confined to a small opening made by forcing a large vent wire through the sand immediately above a narrow flange or pocket in the cope. Gas and steam show a tendency to collect in confined spaces, pockets, bosses, the top of thin wheel rims and other similar localities. The iron sets rapidly in these isolated places and may trap some of the gas unless provision is made for rapid escape. The whistler at the highest point supplies the exit.

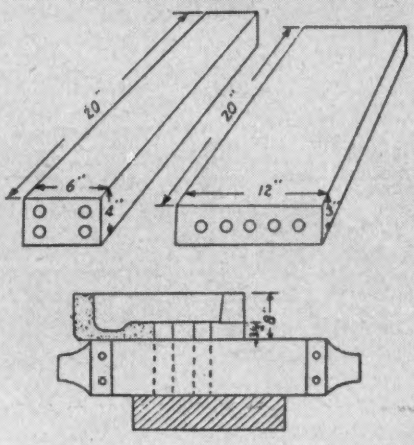

Fig. 2—Top: Perspective view of runner cores. Bottom: Core in use

Where a large riser is employed as a feeder, ferrostatic pressure exerted through the semiplastic mass pushes the crystals together. The riser must be designed to solidify last, otherwise it may draw metal from the casting. Chills also may be used near the heavy sections. Pouring metal at a higher than usual temperature may eliminate shrinkage. The surrounding sand becomes dry and hot before metal solidification commences and helps to equalize the cooling speed throughout the casting. One of the most widely used preventives of shrinkage is a reservoir of molten metal varying in size and shape according to local conditions and known as a sinkhead, feeder or riser.

Editor's Note: This is the second of three discussions on the subject of gating. The concluding installment will be presented next month.

SILICON AND ITS EFFECT ON CAST IRON

By DONALD J. REESE, International Nickel Co., New York

LAST month we discussed the important effect of carbon in cast iron. Carbon and silicon are the principal elements in unalloyed cast iron. Silicon, a nonmetallic element resembling graphite in appearance, occurs in the earth's crust in the form of silica. The source of silicon in cast iron is mainly pig iron. The iron-bearing minerals used in the blast furnace to produce pig iron contain silica (8-10 per cent) as an impurity, and silica is reduced to silicon in the same smelting operation that reduces iron minerals to pig iron. Whereas pure iron weighs 490 pounds per cubic foot and melts at 2795° F, silicon weighs only 150 pounds per cubic foot and melts at 2588° F.

Silicon is dissolved by ferrite (iron) to make it stronger and harder. Silicon strengthens ferrite by 12,000 psi per 1 per cent silicon, so that a tensile strength of 36,000 psi for ferrite becomes 48,000 psi with the presence of 1 per cent silicon in the ferrite.

Although silicon hardens ferrite, it is often referred to as a softening element in cast iron. This apparent inconsistency is due to the structure of cast iron which has been called "steel interspersed with graphite." If the steel has a brinell hardness number of 200 and it was interspersed with 5 per cent graphite (by volume) the composite hardness of the steel and graphite would be 190 without any change in the hardness of the steel, or if it was interspersed with 10 per cent graphite the composite hardness would be 180. Within certain limits silicon decomposes cementite (Fe_3C) to iron and carbon to increase the amount of graphite to be interspersed, and the rate at which silicon hardens the steel matrix is less than the rate at which additional interspersed graphite lowers the composite hardness.

Many of the materials used in the cupola charge—regular pig iron, silvery pig iron, cast iron scrap or ferrosilicon—are the sources of silicon in cast iron. A popular type of cast iron contains 2 per cent silicon or 40 pounds of silicon per 2000 pounds of metal. The cost of silicon in the various raw materials used in the cupola charge varies widely. In addition to a variable cost depending on what raw materials are used, there is also a melting loss in the cupola.

Normally, with room temperature air the loss of silicon in the cupola is calculated at 10 per cent; so to obtain an iron with 2.0 per cent silicon from the cupola the ingoing metal charge should contain 2.22 per cent silicon. However, the oxidation loss of silicon in the cupola may be much higher than 10 per cent if the form of the raw material containing silicon is not suitable for use in the cupola melting process. For example, a 5-lb lump of ferrosilicon might be part of the metal charge or it might be 5 lb of finely crushed ferrosilicon. The silicon oxidation loss would be much greater with the crushed material than with the lump material due to the greater surface exposed to oxidation.

When the initial cost of silicon is adjusted for cupola oxidation losses, to determine the cost of silicon in the metal tapped from the cupola, the costs would vary from 6.6 to 14.3 cents per pound. As a foundry ships only about two-thirds of a ton of product from each ton of iron tapped from the cupola, the cost of silicon in the castings must be adjusted further to obtain a true accounting of expense for silicon. Foundry costs in producing a 2 per cent silicon cast iron may be influenced by a variation in costs as much as $5 per ton of castings, depending

(*Concluded on page* 184)

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(*Concluded from page* 182)

on the cost considerations of silicon. The following table will give some idea of the cost of silicon in various grades of ferrosilicon.

Lump Ferrosilicon	Cost Per Pound Contained Silicon
50%	15.05 cents
75%	16.75 cents
85%	17.80 cents
90-95%	19.65 cents

Some of the American Iron and Steel Institute classifications of pig irons used in the foundry are shown in the accompanying table.

Note that fundamentally the various classifications of pig iron are based on the phosphorus content. Within these classifications there are other gradings based on silicon content. Thus, No. 1 foundry contains 2.50 to 3.00 per cent silicon ($2.75 \pm .25$); No. 2 foundry 2.00 to 2.50 ($2.25 \pm .25$); and No. 3 foundry 1.50 to 2.00 ($1.75 \pm .25$) silicon.

An iron-silicon alloy is frequently referred to as "ferrosilicon" if the alloy contains more than 5 per cent silicon, but it is more common to refer to grades containing 5 to 20 per cent silicon as "silvery" pig iron. Most of these grades are made in the blast furnace but they are also produced in the electric furnace. More specifically the term "ferrosilicon" refers to an electric furnace product which contains 50, 75, 85 or 90 to 95 per cent silicon. Ferrosilicon is marketed in various forms: As lump ferrosilicon, several sizes of crushed ferrosilicon and as briquets. A silicon briquet is composed of crushed 50 per cent ferrosilicon bonded together with cement or other binder in which there is an exact quantity of silicon, either 1 or 2 pounds of silicon. The total weight of silicon, iron and binder is 2.5 and 5 pounds, respectively.

A technique employed in many gray iron foundries is to add some form of silicon to the metal after it has been tapped from the cupola (or other type of melting furnace) and not charge all of the desired silicon in the cupola. This technique is termed "inoculation" and is sometimes referred to as a late silicon addition. A great many silicon alloys are offered to the foundry industry as inoculants but the more common are crushed ferrosilicon and calcium silicide. The inoculating technique helps achieve a better distribution of graphite, increases tensile strength, improves machinability and usually increases the service life of cast iron in many of its applications. Inoculation usually means adding 0.25-0.50 per cent silicon to the metal.

Cast iron is unique among engineering materials in that its chemistry (carbon and silicon) is adjusted for section size in the casting. Section sizes of cast iron may be as little as 0.1-in., in a piston ring, or as much as 50 in. in a steel mill back-up roll. Generally, casting sections are ½ to 1½ in. In a very light section, as illustrated by the 0.1-in. section piston ring, the iron chemistry might be 3.7 per cent carbon with 2.8 per cent silicon. In a very heavy section, as illustrated by the 50-in.-diameter steel mill back-up roll, the iron chemistry might be 2.0 per cent carbon with 1.8 per cent silicon.

Generally, light-section castings have medium to high total carbon contents (3.25-3.75 per cent) along with relatively high silicon contents (2.25 to 3.25 per cent). Before the foundry industry mastered carbon control in the cupola, increasing casting sections had relatively high carbon contents (3.3-3.5 per cent) and all adjustment for chemistry was to use less and less silicon with increasing section. For example, the silicon content of a 10 to 20 in. section might be 0.6 to 0.8 per cent silicon. However, as the industry now has knowledge on how to control carbon in cupola melting, the trend in chemistry adjustment for section increase is downward in carbon but with little or no change in silicon content.

Medium heavy sections (2 to 8 in.) in mining machinery at one time were made of a cast iron containing 3.3 per cent total carbon and 1.0 to 0.8 per cent silicon. In recent years, a much improved iron for these parts has contained 2.5 per cent total carbon and 2.5 per cent silicon.

It has been previously stated that increasing quantities of graphite lowers the strength of cast iron while silicon increases the strength of ferrite, so the modern cast iron metallurgist uses this information to make better qualities of cast iron.

White cast irons are usually low-silicon irons containing approximately 0.5 per cent silicon. Chilled or mottled irons are also relatively low silicon irons of 0.5 to 1.0 per cent silicon. White cast iron means that the appearance of a fractured section is white and that all of the carbon present in the cast iron is in the combined form. Chilled iron means that one portion of the casting has been cast against a metal "chill" resulting in rapid cooling and a white structure at that point; but the remainder of the casting, away from the chill is gray and machinable. Railroad car wheels are an example of chilled iron with a white iron tread and the flange, web and hub gray. Mottled irons have structures intermediate between white and gray—structure with excessive amounts of combined carbon but with some graphite. It is to be noted here that white, chilled and mottled irons are all relatively low-silicon irons.

Malleable Iron Annealed

Malleable iron foundries actually make white cast iron which is heat treated (by annealing) to precipitate carbon; after this treatment, the material is ductile. The white iron chemistry of malleable iron is approximately 2.5 per cent total carbon and 1.0 per cent silicon.

Although most of the white, mottled, chilled and engineering grades of cast iron are made with silicon contents between 0.5 and 3.0 per cent, several foundries in the United States make a very special type of cast iron for chemical equipment which contains 12 to 15 per cent silicon. Some relatively new types of cast iron designed for heat or corrosion resistance contain 6 per cent silicon but they also contain other alloys.

Silicon, manganese, carbon and iron are oxidized (combined with oxygen) in the order given, and at the high temperatures existing in the cupola these reactions are much faster than at room temperature. A foundryman says he produces "oxidized" iron when he actually means the silicon or carbon chemistry of the iron is less than was intended after allowance for normal conversion losses in cupola melting.

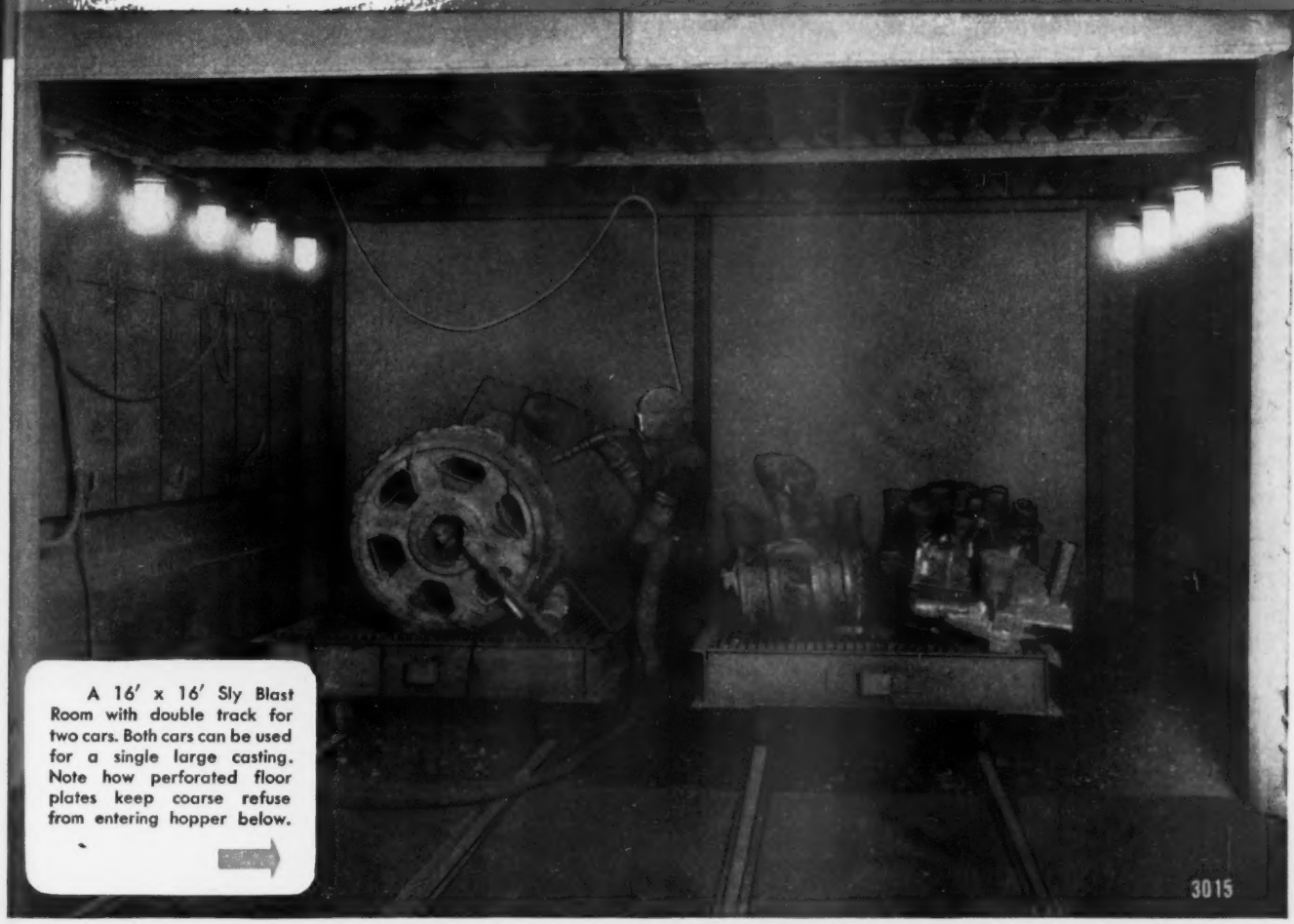
Classifications of Foundry Grades of Pig Iron

Name	Phosphorus, Per Cent	Silicon, Per Cent	Sulphur, Per Cent	Manganese, Per Cent
Bessemer	.076-.10	1.0-3.0	.05 max.	1.25 max
Malleable	.101-.30*	.75-3.5	.05 max.	.5-1.25
Foundry—Northern Low Phos.	.301-.50*	1.5-3.50	.05 max.	.5-1.25
Foundry—Northern High Phos.	.501-.70	1.5-3.5	.05 max.	.5-1.25
Foundry—Southern	.70 -.90	1.5-3.5	.05 max.	.4- .75
Silvery	.30 max.	5.0-17.0	.05 max.	.5-1.25

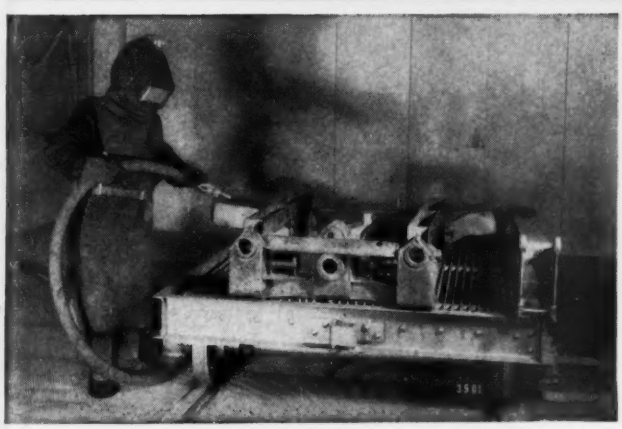
* Malleable pig is usually furnished within phosphorus limits of .101-.20 and northern low phos within .201-.50.

SLY

ARMOURED* BLAST ROOMS



A 16′ x 16′ Sly Blast Room with double track for two cars. Both cars can be used for a single large casting. Note how perforated floor plates keep coarse refuse from entering hopper below.



This view shows a Sly Blast Car in a Sly Blast Room. Perforated floor plates are supported by grating preventing plates from warping. Observe how tops of rails are flush with floor. Operator wears a Sly "Purair" Helmet.

Whatever Size Your Castings

And whatever your tonnage we have a standard blast room to suit. We have built blast room equipment for the cleaning of the inside of tank cars, for large airplane fuselages, for structural assemblies, tanks, railroad cars and locomotives. Some large blast rooms are self-contained buildings.

Standard Sly Blast Rooms

Inside Width: 8 ft., 10 ft., 12 ft., 14 ft., 16 ft.
Inside Length: 8 ft., 10 ft., 12 ft., 14 ft., 16 ft.
Inside Height: 7 ft. 3 in., 8 ft. 3 in., 9 ft. 3 in.
Larger Blast Rooms for special purposes.

***ARMOURED** { **An extra layer of detachable 3/16″ steel wear plates to protect the walls.**
An extra layer of steel grating to reinforce the floor against sagging.
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HOW TO USE THE CUPOLA

Part II

By BERNARD P. MULCAHY
President
Fuel Research Laboratory Inc.
Indianapolis

THE importance of a "plumb" alignment of the cupola cannot be overlooked. We are all familar with an old law of physics which states that "liquids seek their own level", and in operating a cupola we have two distinct liquids to consider—the iron and the slag.

The question of alignment is particularly important with old cupolas, because they are the ones most likely to have been thrown out of "plumb" by broken or warped legs, wrinkled shells or sunken foundations. This condition is not usual, but it can exist and has been found to cause tuyere pluggage and poor lining repairs.

If a cupola is not in correct vertical alignment, we can, of course, expect that the lower side could have its tuyeres actually lower than the slag hole, at least enough to permit slag to enter them in the course of the heat. By actual measurement tuyeres have been found to be 2-3 in. lower on one side than the other.

Buckling of the shell can result in an area difficult to reline properly where conventional fire brick are used.

Checking the vertical alignment of the cupola is not difficult. A plumb bob suspended from the center position of the cupola at the door level to a "center" at the tuyeres will quickly show whether the cupola is straight or not. New cupolas, of course, should be checked as erected.

Original Lining—By this is meant a new lining throughout. Well-burned fire brick should be selected, using the blocks designed to fit the particular cupola. Sometimes blocks of incorrect size are used which prevent tight joints to be formed. This should not be a regular practice because of the excess "fill" required. "Mud" or a plastic clay bond is a poor substitute for a well burned fire brick.

The original lines of a well designed cupola of 78-in. shell diameter and lined to 60 in. are as follows:

Well—24 in. total depth, tuyeres to doors. Diameter 60 in.

Slag Hole—1½ in. diameter, top 4 in. below tuyere.

Sand Bottom—Front 5 in. deep, rear 7 in. deep, slope 2 in.

Actual Well Depth—24 − (4 + 1½ + 6) = 12½ in.

Bosh—Diameter 54 in., height 12 to 24 in., taper 12 to 18 in.

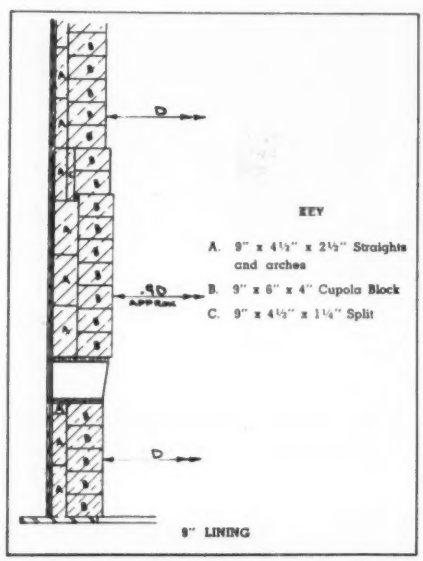
Lining—60 in. starts 30 to 42 in. above tuyeres.

Operating Height—16 to 22 ft., doors to sill.

In lining a cupola the brick should be tightly set with a minimum of mortar between brick to produce tight joints. Each course should be carefully laid, and retention rings (on shell) should be located at proper intervals to support the lining.

The bosh is an important part of the design of all cupolas. It will vary from 2 in. for small cupolas to 6 in. for cupolas lined to 72 in. A properly built and maintained bosh will aid materially in operation and lining repairs.

Construction of a bosh is not difficult, but it is not possible with tuyere plates having the same diameter as the well. In other words, the upper tuyere plate should extend beyond the operating diameter a distance which will properly support the overhang. This distance should be 1 in. less than the brick overhang.



Illustrating cupola bosh construction

In the example given we show a 3-in. bosh; that is, the diameter of the cupola at the top of the tuyeres is 6 in. less than the well or in the melting region.

The purpose of the bosh is to permit the slag to flow past the tuyeres without entering them, and additionally it conducts the air into the coke a greater distance for better ignition of the bed.

If split tuyere plates (upper) are used, it will be found that repairs in the melting zone can be materially simplified, because the front sections can be easily removed for replacement. This frequently eliminates the necessity of removing all the lining back to the shell.

Move Brick Forward

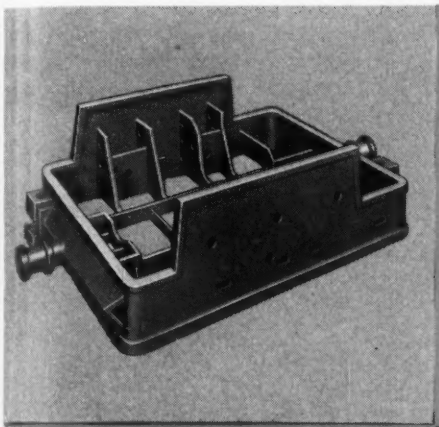
With the proper tuyere plates in location, the regular lining brick is moved forward the distance desired. In some cases this may require a different brick size than the regular lining in order to form the new circumference. The volume between the lining brick and the shell can be filled with standards, splits or other brick sizes depending on the bosh. These backing brick must be carefully laid to produce a solid wall. If the bosh is to be 18 in. high, and 3 in. out, this can be accomplished by standards for the backing brick and four courses of blocks (4 in. high plus bond). At this point the bosh is gradually tapered back to the regular lining diameter. This construction is shown in the accompanying illustration (Whiting Corp. Bulletin No. 237-R).

With mechanical charging it is imperative that iron blocks be used below the charging hole because of impact damage from charging. These should be properly supported originally and so maintained. Daily inspection of a general nature by the repair man should be made and reported to avoid loose blocks and patches falling on the repair crew. The stack above the door should be carefully checked; frequently this is neglected completely. Inspection should also include the shell, which may have buckled because of age, heat, or being too thin as originally installed. Repairs should be made promptly.

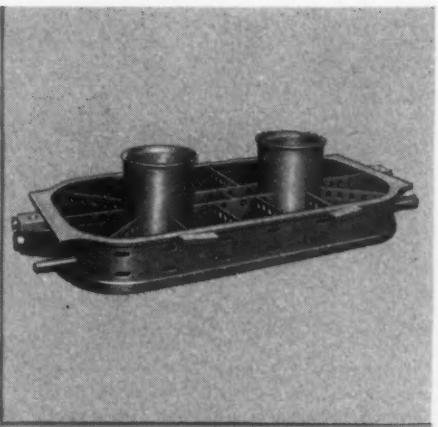
In making repairs to the lining in the well and hot zone, first carefully remove all slag. In most instances the well will require only cleaning.

(*Continued on page* 188)

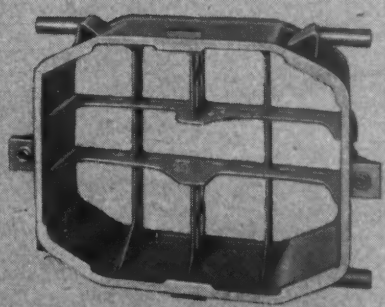
TYPICAL *Industrial* Standard Fabricated Flasks



Foundry efficiency demands unusual shapes and sizes for economical production

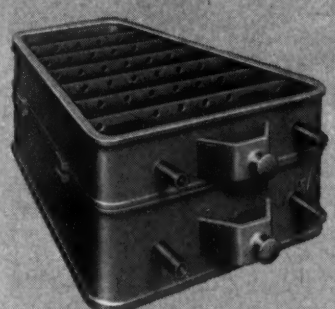


Cut-Away Cylinder Block Flask



Twin Stack Converter Housing Roll-Off Flask

"A" Type Tool Base Flask



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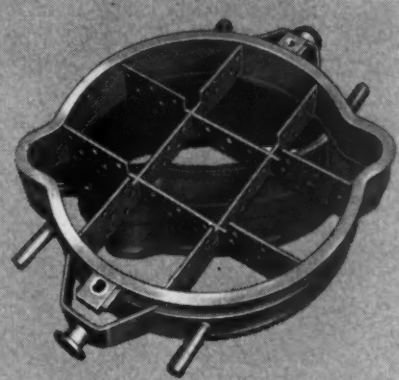

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(*Continued from page* 186)

The breast and slag hole, however, generally require daily replacement. If the well gives daily evidence of excessive erosion it is because there is something wrong and it should be corrected immediately. It may be due to:

a—Poor slag composition (too alkaline).
b—Poor original repairs, or improperly dried (thermal shock).
c—Improper positioning of slag hole; too low—too much slag in well.
d—Improper air distribution through tuyeres.
e—Excessive action at slag hole.

In making repairs to a cupola, particular attention should be directed to whether the lining is burned out in one area to a greater extent than another. If so, this is due to excessive air *at this point.* Contrary to published opinion, a cupola does not, nor cannot, "cross-fire." Excessive erosion generally can be corrected by partially blocking off the tuyere or tuyeres at the point of greatest burn-out.

Flux Not Responsible

The writer has encountered many instances where excessive erosion in the melting zone has been attributed to localized charging of the flux. Conceivably such localization could cause this burn-out, but in the majority of cases this is not the real reason, because the flux is disturbed in its descent and does not remain concentrated. Correction of the air distribution as suggested above will be found to be most effective.

The depth and height of the burn-out is a function of the composition of the slag and the rate of driving; a highly alkaline slag and a high driving rate will increase erosion.

Generally repairs are poorly made and improperly supervised. All eroded surface should be thoroughly chipped clean from slag. All surfaces to be repaired should then be washed with a thin mixture of the patching mortar to provide a good bond. If brick or shapes are used for repairs it is easier to have the repaired lining conform to the original dimensions: Sandstone, splits and standards are frequently used and "mudded" into position oftentimes resulting in a very insecure patch.

Recently a patching "gun" has been employed using a previously mixed material of balanced refractory compositon. In general, the reports of service of this practice have been good. This is logically so because the refractory is balanced

chemically and the moisture content is held to a proper low level.

All too frequently the composition of the mortar is left up to the repair man who, in his hurry and desire to finish on time, will employ a heavy clay mix because of better plasticity, with the result that the patch will check severely and easily fall off. A good mortar can be made as follows: Clay 35 per cent, sand 50 per cent, ganister 15 per cent, water 4-5 per cent. (do not use an excessive amount). Mix and let stand 24 hours before use for "tempering".

The lining should be repaired to produce the original dimensions as closely as possible.

A telescoping measuring stick is an aid in maintaining proper dimensions.

The upper tuyere ledge should be intact at all points. Broken top tuyere plates should be replaced to properly support the lining and the bosh.

Mention has previously been made of the slag and tap holes. It is advisable however, to emphasize the important point regarding these ports.

Position of Slag Hole

The position of the slag hole must be carefully determined, because it governs the ability to slag properly and to keep the tuyeres clean during the heat. For the average cupola the top of the slag hole should be 3 to 4 in. below the tuyeres. A closer setting does not give sufficient well capacity to handle the slag if the tap hole is not opened promptly.

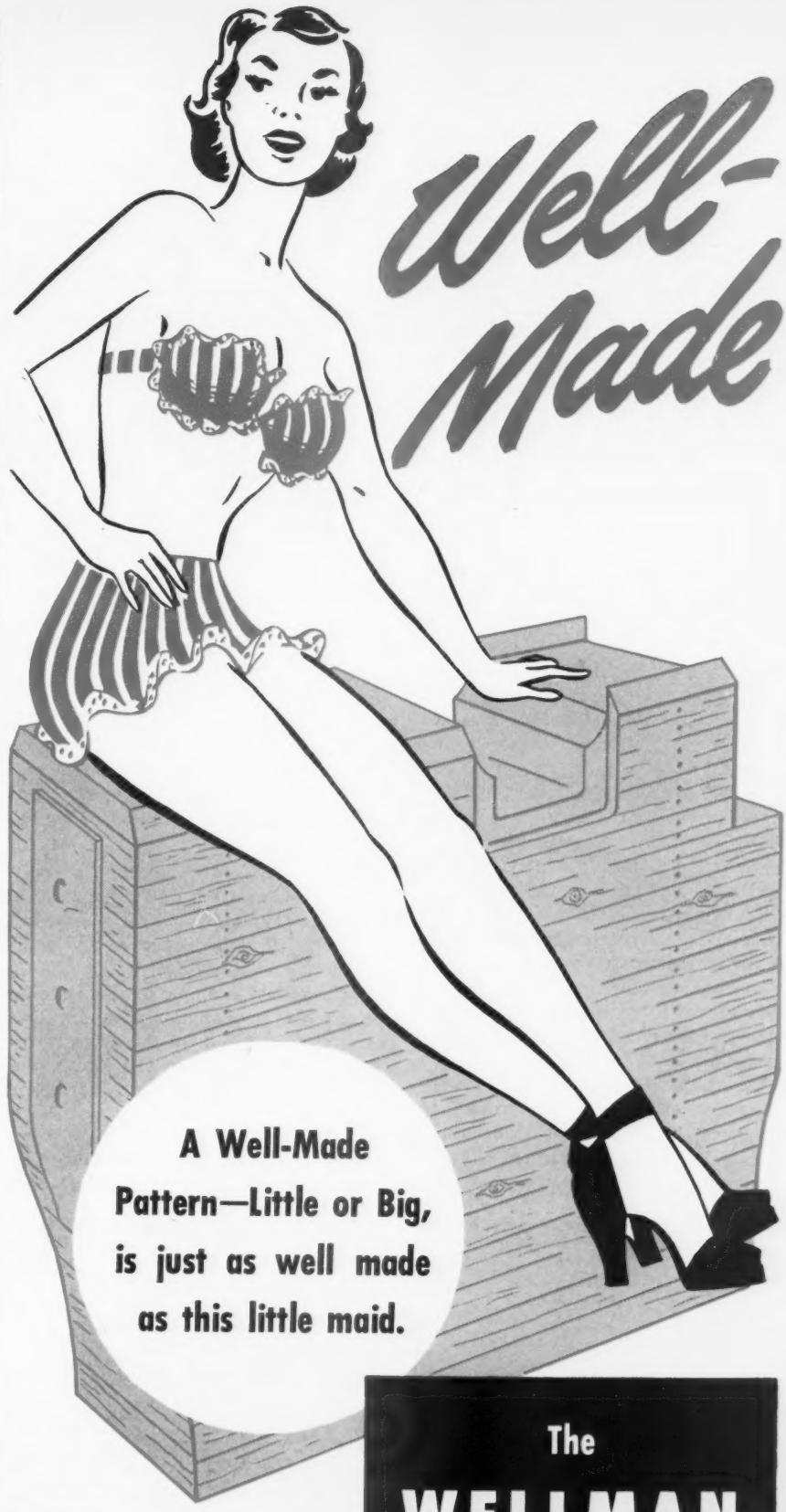
The length of the slag hole is also important. This should not be longer than 9 in. even if the cupola lining is greater than 9 in. Too long a hole tends to permit freezing when difficulty is encountered with the fluidity.

The diameter of the slag hole should be 1½ to 2 in.; seldom is it necessary to have a larger opening. Too small an opening also tends to easy freezing of the slag.

A slag hole block has been found to be more effective than a hand constructed hole. They are readily available and easily installed. The silicon-carbide block particularly has been found to give excellent service. For short heats these blocks can be used for several days.

For long heats some shops install two slag hole blocks side by side to avoid a shutdown for repairs during the heat if the first hole plugs up.

(To be continued next month)



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HANDLING CUPOLA CHARGES

Facilitated by Power Trucks

By HARRY G. MOUAT
Birmingham

Placing 750 pounds of coke and 270 pounds of limestone in charging bucket at Anniston Foundry Co., Anniston, Ala. Buckets are handled on skids

USING manual labor to handle raw materials from stockpiles to cupolas is one of the most unsatisfactory ways of accomplishing this job, as many foundrymen know from experience. It requires a large labor force at hard and sometimes hazardous work. Under some circumstances it may appear to be the least expensive method, but it actually runs up payrolls and related expense unnecessarily high while adding nothing of value to the product.

This handling cost, from stockpiles to cupolas, has been greatly reduced in many instances with a few units of mechanical equipment. In one case studied recently production was increased 50 per cent while the ratio of outlay for labor to output was lowered substantially. This resulted from installation of two power trucks to transport the materials from stock to foundry and a mechanical charger to pick up charging buckets from the trucks and convey them to cupolas. The study discloses two important facts:

First, trucks provide the flexible means of transport so that yard or plant layout need not be revamped to gain advantages from modern cupola chargers and other mechanical equipment.

Second, the same trucks not only facilitate the flow of raw materials but assist in other operations within the foundry, and in storage and shipping.

A practical example of this is to be found at the Anniston Foundry Co., Anniston, Ala., one of the largest producers of soil pipe in the South.

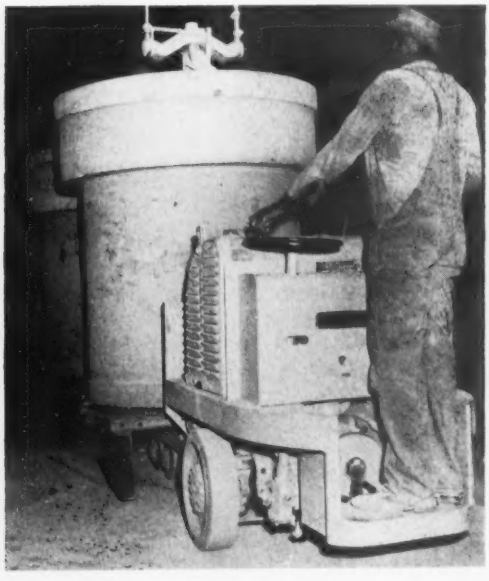
First, an overhead-rail, horseshoe type charger was installed to serve two cupolas. At the same time it was decided to expedite the inbound movement of raw materials from stock, as the former method of loading and pushing wheel trucks on narrow gage tracks was too slow and impracticable.

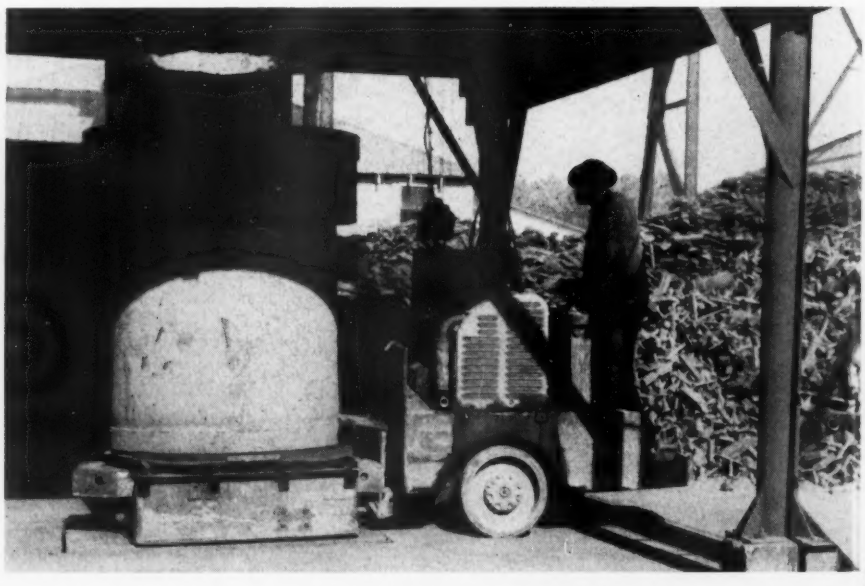
Now the cone-bottom charging buckets are transported between make-up points and cupolas by two platform type power trucks. These trucks, of 10,000 pounds capacity, were built by Elwell-Parker Electric Co., Cleveland.

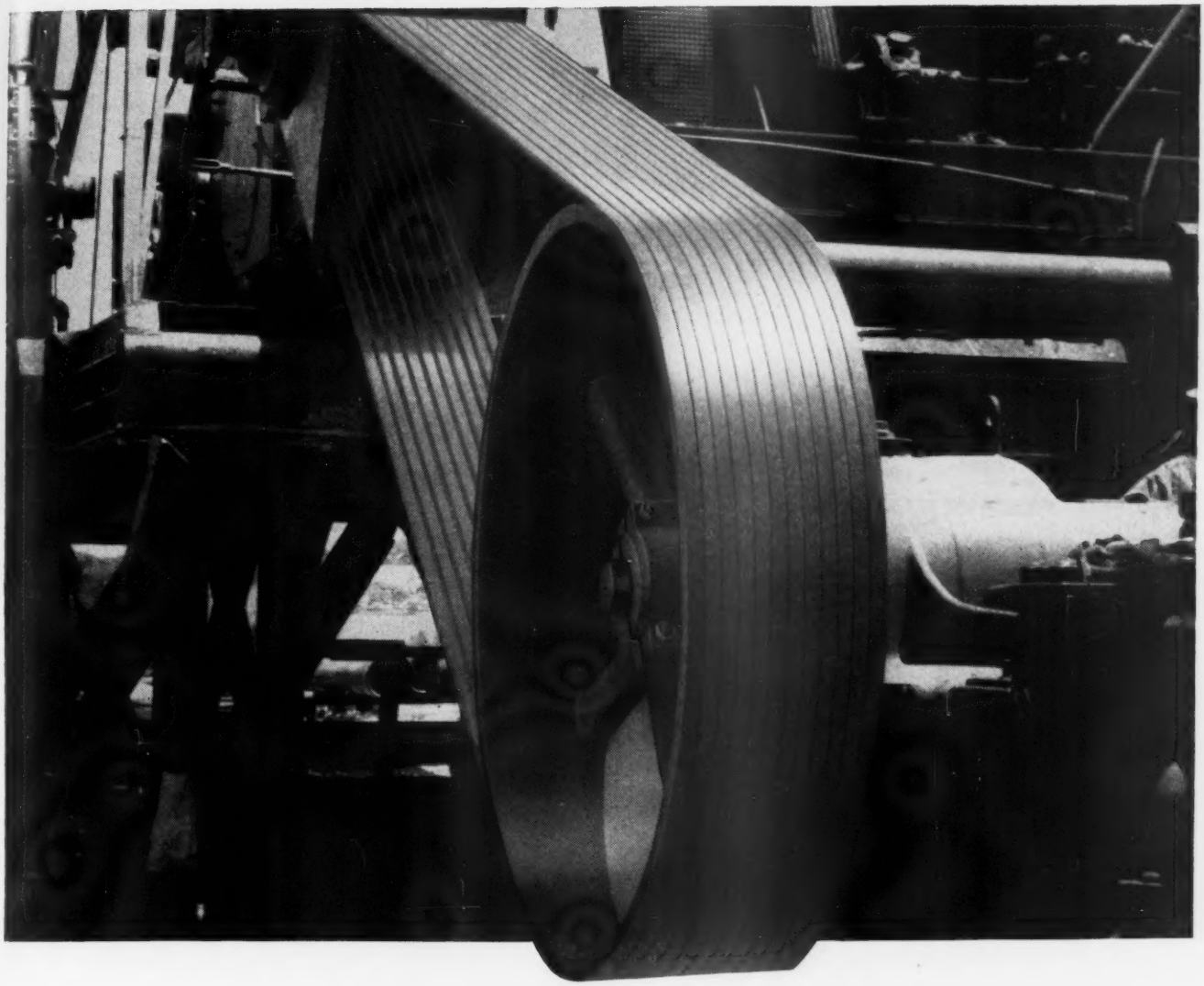
The buckets weigh 3600 pounds each and a charge consists of 5000 pounds of pig iron and scrap, 750 pounds of coke and 270 pounds lime-

(*Concluded on page* 192)

(Below left)—Loaded bucket, weighing 9620 pounds, ready to be hoisted to cupola charging door. *(Right)*—Scrap and pig iron are loaded at this point







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(*Concluded from page* 190)

stone, total 9620 pounds. In eight hours the two trucks handle a total load of 450,000 pounds, which includes some pipe from foundry to cleaning room, the scrapped pipe from cleaning room to stock, and other jobs.

The trucks accomplish three times the amount of work which formerly was done manually, and this with less effort and much greater safety.

Economies which immediately became apparent, plus broadening demand for the product, led recently to the installation of a third cupola, a mechanical charger to serve this unit and a third truck.

A remarkable fact is that general layout of the plant and yard remains unchanged. Make-up points are adjacent to freight tracks and about 100 feet from the two original cupolas. Located between the pig iron and scrap piles is a loading hopper. An important aid in speeding preparation of the load was the installation of a heavy-duty magnet. Suspended from crane this handles iron and scrap from freight cars to stockpiles and from stockpiles to loading hopper.

Charging buckets are handled on skids just high enough for a truck's platform to run underneath for lifting. A truck with charging bucket runs onto the weighing platform directly beneath the chute leading from the loading hopper. Here it receives the pig iron and scrap. The bucket is then transported to coke and stone bins where these ingredients are added.

Transported to the foundry the bucket is lifted off the skid by a Whiting crane-type charger and transferred to cupola. The empty bucket is returned and deposited on a skid. By that time a new load has arrived and is ready for the pickup. Truck returns with empty bucket to makeup point.

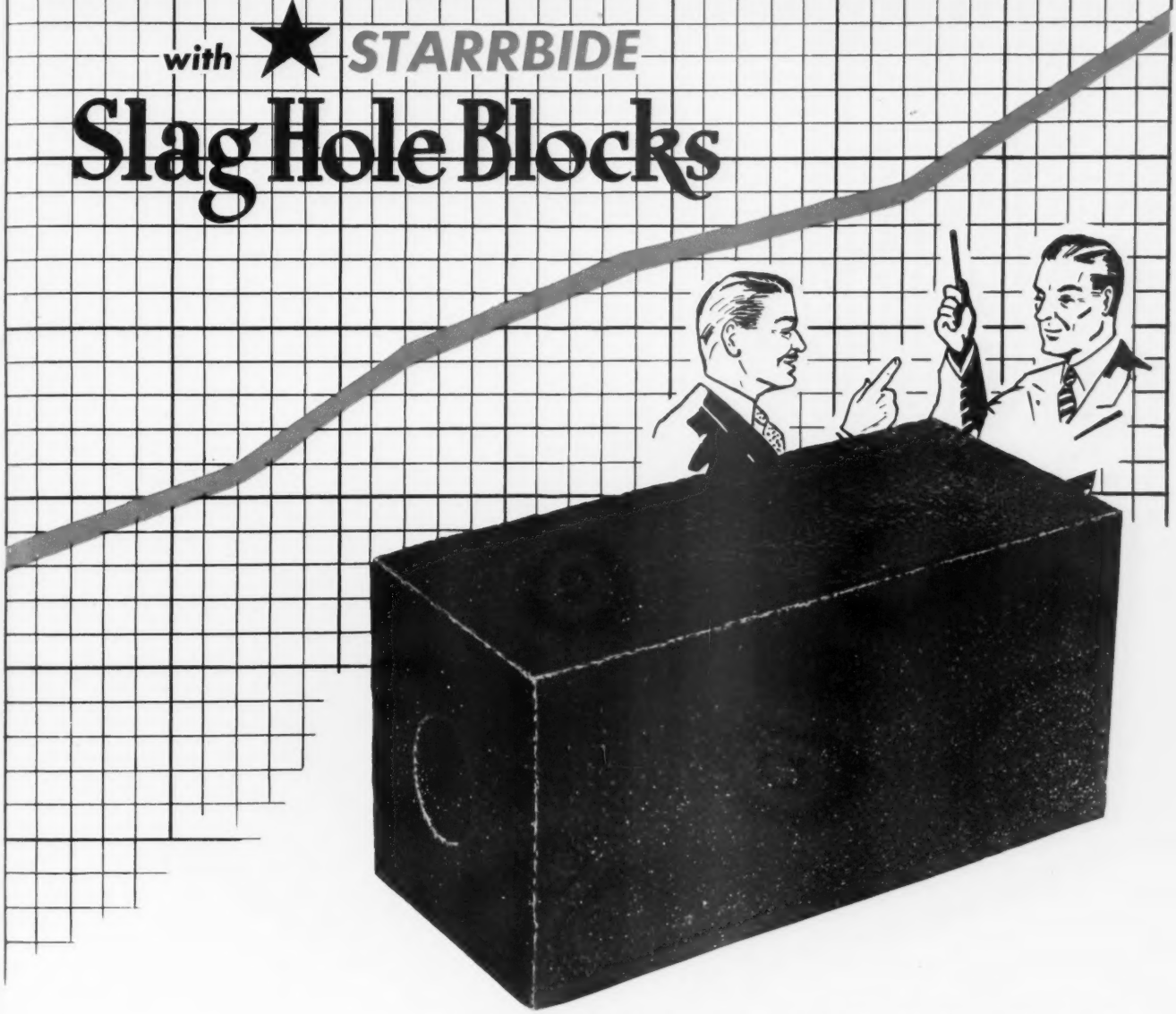
The movement is simple, continuous and effective, accomplished with less difficulty and supervision than ever before. Hard manual labor has been reduced to a minimum. The time factor in this handling cycle has been so shortened the trucks also engage in many other loading and transporting jobs in the foundry and yards.

Eriez Mfg. Co., Erie, Pa., producer of magnetic equipment, has appointed the Engineering Products Co., Charleston, W. Va., as sales representative. George Garrett and Ralph Crump, engineers, are members of Engineering Product Co.'s sales force.

GREATER CUPOLA PRODUCTIVITY

with ★ STARRBIDE

Slag Hole Blocks



★ STARRBIDE ***Carbon-bonded*** slag hole blocks last longer than blocks bonded with any other material.

★ The absence of fusible materials, such as clay, plus the high thermal conductivity of STARRBIDE itself which rapidly dissipates heat at the slag hole, reduces erosion from heat and slag flow to a heretofore unheard of low.

★ STARRBIDE slag hole blocks afford better flow control and longer pouring runs for foundry cupolas — are, therefore, a "must" in foundries faced with high production schedules. Write for full details.

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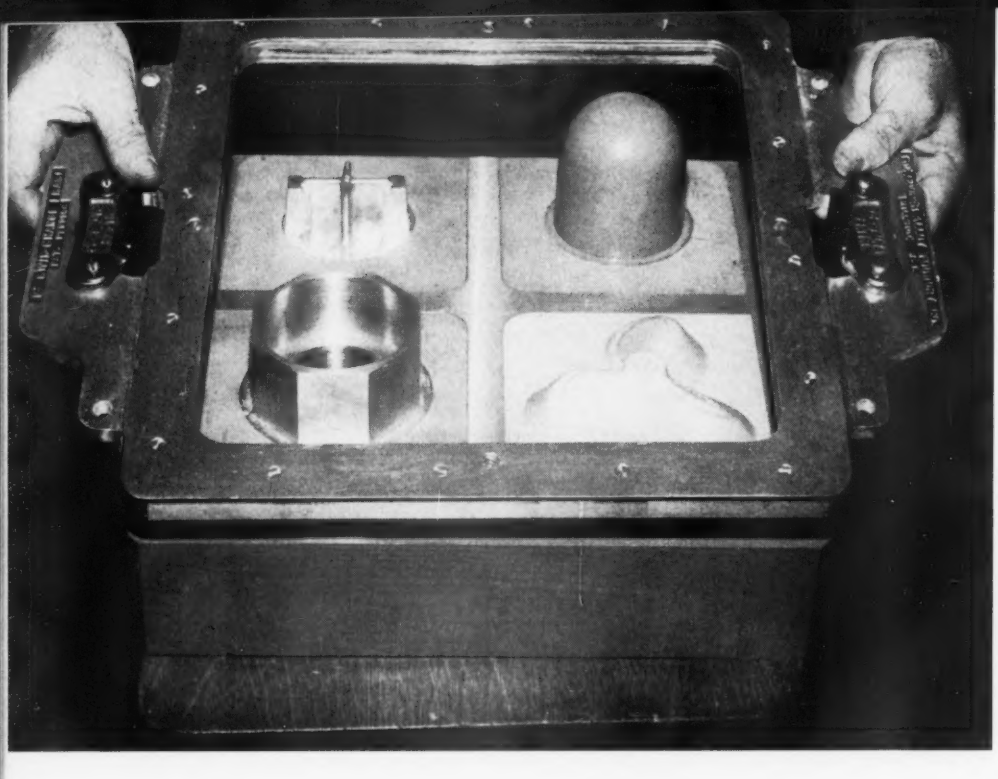


Fig. 1—A half turn of the four eccentrics brings the hardened steel blades into intimate contact with the insert

Develops New Type

Matchplate Frame

By FRANZ SCHUMACHER

Chief Patternmaker
Cooper Alloy Foundry Co.
Hillside, N. J.

A NEW and improved type matchplate frame shown in the accompanying illustrations and distributed by the Foundry Accessories Sales Division of Cooper Alloy Foundry Co., Hillside, N. J., was developed by the author. Patents now are pending. It was developed as an answer to the need for a holding device for matchplate inserts which would show simplicity of operation, flexibility as to the types and sizes of matchplates which would be utilized and which would provide for rapid switching of matchplates, as well as long-life service.

Cast in aluminum, the solid one-piece frame is reinforced with ⅛-in. steel strips to insure maximum surface wear. Changes of matchplate inserts can be made in approximately 20 seconds. The frame does not have to be removed from the flask for replacement or change of patterns. The operation requires only a half turn of four eccentrics with an ordinary screw driver either to remove the pattern from the frame or to lock it securely in place. There is not a single loose piece or screw. No loosening or shifting is possible in service. The accompanying illustrations show the principal features.

Typical method of inserting four patterns in a standard cross is shown in Fig. 1. A simple half turn of the four eccentrics brings the hardened steel blades into intimate contact with the patterns to insure sturdy support. The four matchplate sections show the versatility of the device. All patterns have irregular parting lines. Aluminum patterns inserted in plywood are shown at the left. A wood pattern inserted in the same manner is shown in the upper right. An all-plastic insert is shown at the lower right.

Fig. 2 shows how single patterns may be mounted on boards to fit various size frames. In Fig. 3 the use of a standard cross bar permits the insertion of four patterns. Any one or more may be changed rapidly. The use of a single bar, as shown in Fig. 4 permits the insertion of multiple patterns of various sizes. This design makes the cross bar unnecessary and is recommended in its stead.

Although the inserted plates may be aluminum, wood or plastics, experience indicates that plastic-coated plywood is the most satisfactory and economical material. It holds accurate outside dimensions. It is light in weight. It serves for as many molds as aluminum, because the flask rides on the steel-faced frame, instead of on the insert. Patterns mounted on plywood and inserted in the frame present not only a matchplate for short orders, but may be regarded as a high productivity matchplate, just as good as a full cast aluminum plate.

Preparation of the inserts is simple. The insert is cut to fit the opening,

(*Concluded on page* 196)

Fig. 2 — Single patterns may be mounted to fit various size frames

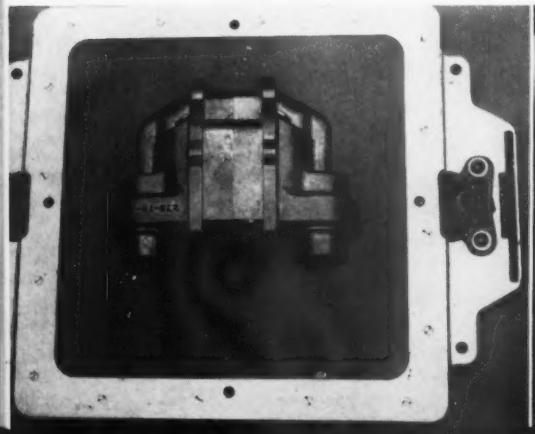


Fig. 3 — A standard cross bar permits the use of four patterns

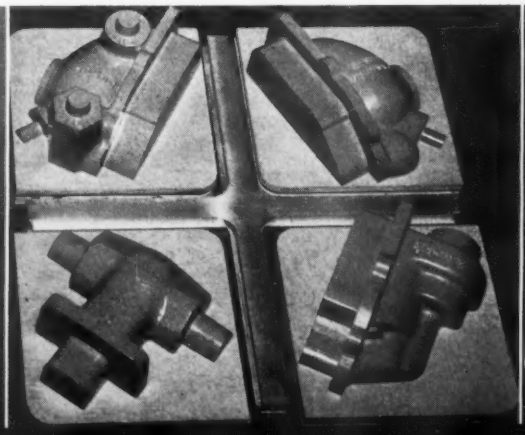
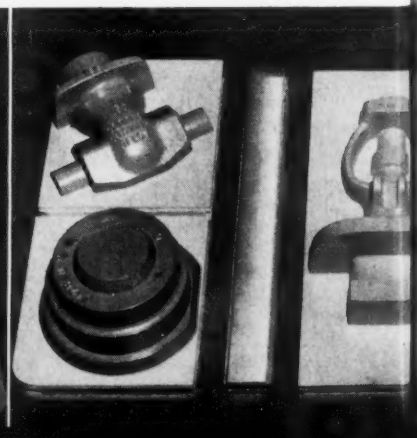


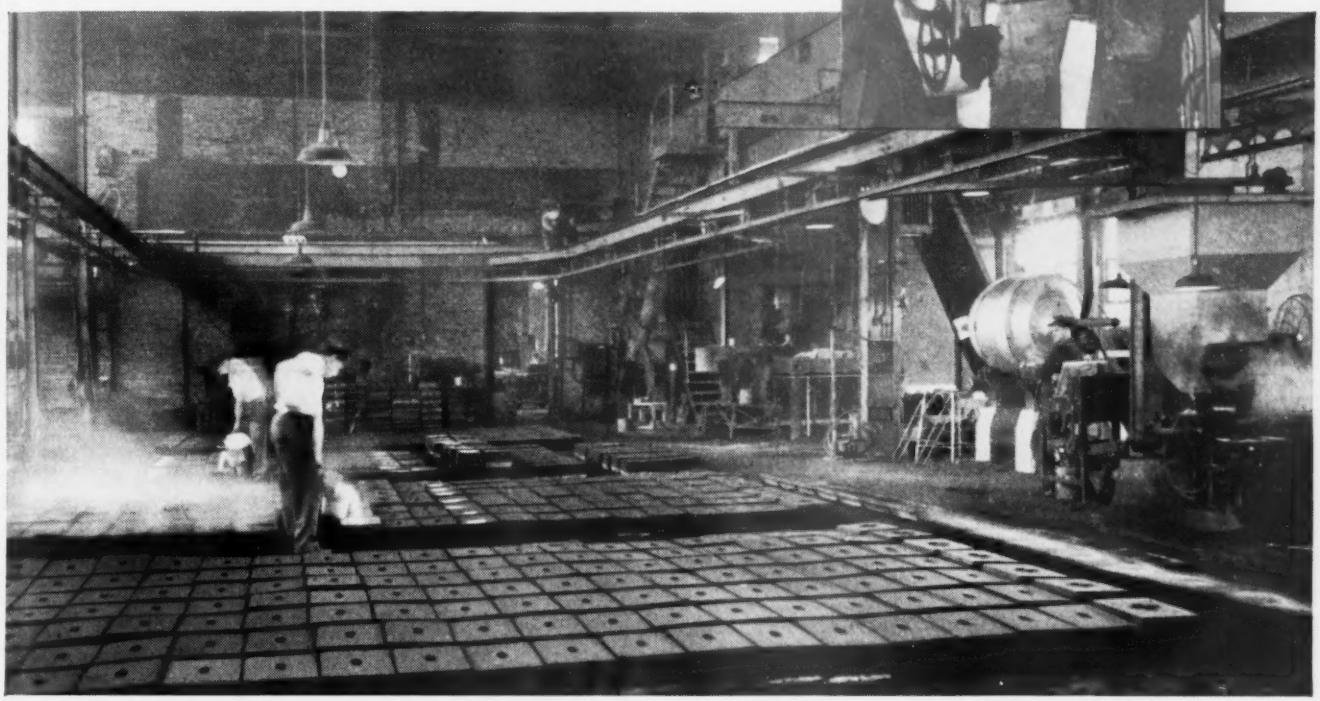
Fig. 4—A single bar permits the insertion of numerous patterns



Borings Wanted...

as is

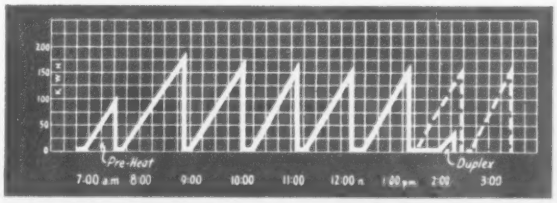
Detroit Rocking Electric Furnace, purchased to remelt borings from concern's own machine shop, proved so fast and efficient that the company buys borings outside to keep furnace working. Borings used as is, not briquetted.



Machine shop to melting furnace to molds . . . an efficient operation using DETROIT ROCKING ELECTRIC FURNACE

Here's another example of improved foundry operation with Detroit Rocking Electric Furnaces.

At Standard Automotive Parts Company, the Detroit, started the same time as the cupola, cold melts until the cupola is ready to tap. They usually have six cold heats, then cold cupola iron is put into the Detroit Electric Furnace, heated, and poured into molds. Furnace used, with excellent efficiency, about 80% unbriquetted borings.



Operating graph, Type LFY, 175KW, 700 lb. Detroit Electric Furnace, melting gray iron. Charge, 600 lbs. Total metal, 4200 lbs; total KWH, 1296; av. power consumption, inc. preheat, 617 KWH/ton; total hours operation, 8½; av. melt time, 59 mins.

For ferrous and non-ferrous metal melting, Detroit Furnaces are fast, make optimum use of power, produce metal of uniformly high quality, achieve lowest metal loss by shrinkage.

Send your production data. Our engineers will furnish facts on how Detroit Electric Furnaces will fit into your operations.

DETROIT ELECTRIC FURNACE DIVISION

KUHLMAN ELECTRIC COMPANY • BAY CITY, MICHIGAN

Foreign Representatives: In BRAZIL—Equipamentos Industrias "Eisa" Ltd., Sao Paulo; CHILE, ARGENTINA, PERU and VENEZUELA: M. Castellvi Inc., 150 Broadway, New York 7, N. Y.; MEXICO: Casco, S. de R. L. Atenas 32, Despacho 14, Mexico City, D. F.

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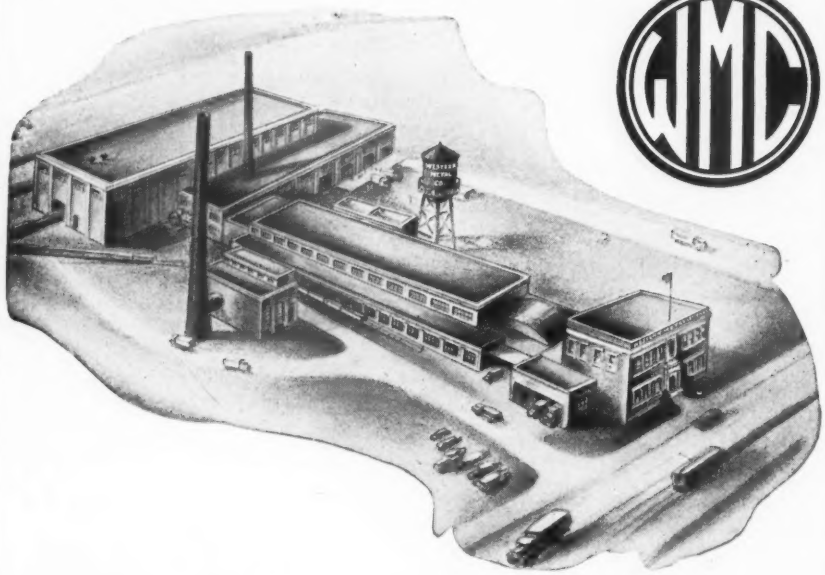

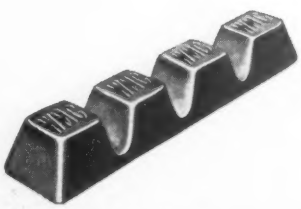

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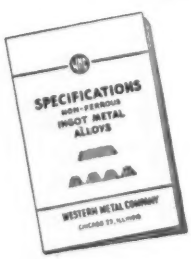

WRITE FOR NEW BULLETIN "F"

Here in one booklet is a complete summary of tables of standard specifications of nonferrous ingot metal alloys for all various modern industrial classifications. This bulletin will be of utmost value to you as will an acquaintance with a truly reliable ingot manufacturer, for the successful operation of your foundry.

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WESTERN METAL COMPANY

Smelters and Refiners of
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(*Concluded from page* 194)

or the area it will occupy in the frame. A groove is cut on the outside edge of the insert to form a recess for the steel blades in the frame. Where the insert is designed to fit against the single bar, or the cross bar, the inside edge is grooved to fit the tongue on the aluminum bar. Actual mounting of the pattern can be performed according to various methods in common practice. A special method is available to those who use the frame.

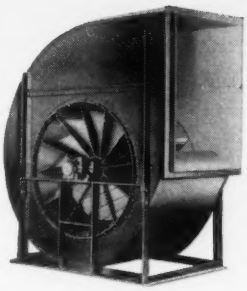
The following advantages may be claimed for the new frame: Elimination of all loose bench work. Better casting for short run orders. Longer life for patterns since flask rides on steel. Matchplate costs cut in half because patterns mounted on plywood boards and inserted in frame will serve for as many molds as full cast aluminum plates. Appreciable saving on pattern inserts. Appreciable saving on storage space. Elimination of many guides, usually needed on every pattern board or plate, now required only on the frame. Additional saving on washers, screws and installation time. Method permits use of small pieces of plywood formerly thrown in the scrap pile. No need to make duplicate patterns to fill a matchplate. No need to adjust guides or install vibrators. Runners and gates can be attached to the divider bar. Matchplates may be switched rapidly.

Book Review

Handbook of Personnel Forms and Records, by Eileen Ahern, paper, 228 pages, 6 x 9 in., published by American Management Association, New York. Price $3.50.

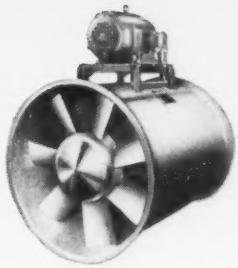
Forms and records used in every major activity of personnel administration are analyzed and illustrated. Accompanying analytical reading matter discusses the content of each type of form, bringing out the objectives of the particular personnel activity and the underlying principles governing its administration. Included are several checklists of items found on hundreds of examples of similar forms.

Handbook covers forms in these categories: Application forms, interview records, references, medical forms, induction of new employees, patent rights of employees, payroll notifications, job evaluation, attendance and absence records, manpower inventory (qualifications records, employee placement or status cards, seniority records, etc.), merit rating, training group insurance, employee discipline, grievance records and suggestion systems.



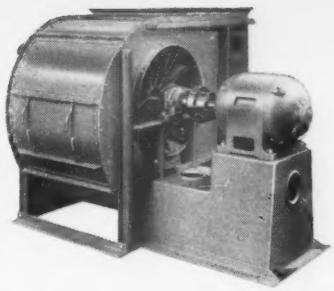
LIMIT-LOAD FANS

For large-scale ventilation. Quiet, non-overloading. Sizes up to 500,000 c.f.m. Bulletin 3675.



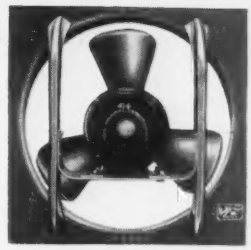
AXIAL FLOW FANS

For light-duty ventilation and air conditioning service. Compact, non-overloading. Bulletin 3533-C.



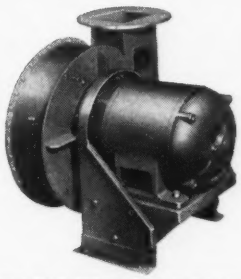
POWER PLANT FANS

Primary, forced draft, induced draft — built for the severest service. Bulletin 3750.



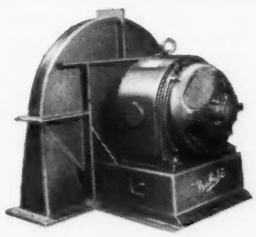
BREEZO FANS

Easy-to-install wall fans. Durable and very economical. 6 sizes. Bulletin 3222-F.



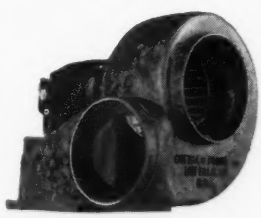
TYPE "CB" PRESSURE BLOWERS

For single-stage pressure blowing up to 2¼ pounds per square inch. Bulletin 3553-A.



TYPE "CC" PRESSURE BLOWERS

In sizes for pressures up to 4 pounds and capacities up to 75,000 c.f.m. Bulletin 3553-A.



BABY CONOIDAL FANS

Compact, for portable or duct-connected service. Quiet, efficient. Bulletin 3499.

"Buffalo" BUILDS THE *RIGHT* FAN FOR THE JOB

Whether you need to ventilate a small room or an entire factory — clean tools with air or give your boiler system the most efficient mechanical draft — "Buffalo" builds the fan for the job! And whatever "Buffalo" fan you pick, you can know that its performance is backed by 73 years of "air know-how". Take a look at the fans shown here, and write us for engineering bulletins by number on any that might fit your particular application!

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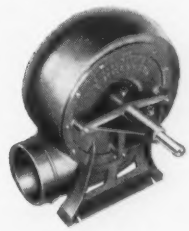
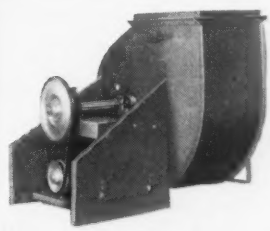


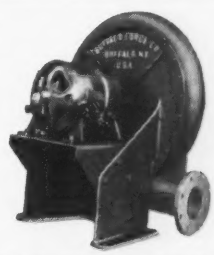
VOLUME FANS

For blowing or exhausting, up to 10" s.p. 8 discharge positions. Bulletin 3615-A.



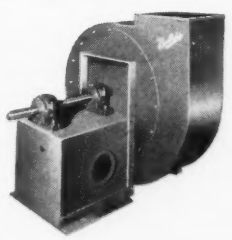
BELTED VENT SETS

Compact, "package" fans for duct or free-air delivery. Non-overloading. Bulletin 3720.



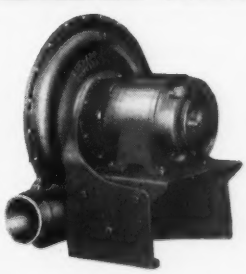
"RE" BLOWERS—EXHAUSTERS

Larger versions of "Buffalo" "E" Blowers, in sizes from 50 to 1600 c.f.m., for pressures up to 40" of water.



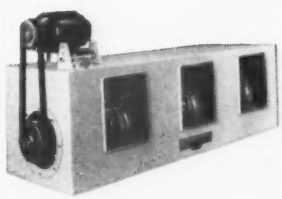
INDUSTRIAL EXHAUSTERS

With interchangeable wheels for air exhausting or materials conveying. All-welded. Bulletin 3576.



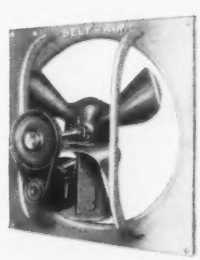
"E" BLOWERS—EXHAUSTERS

For oil or gas furnace blowing, line boosting, cleaning. Bulletin 3014-C.



SHORTBOY VENTILATING SETS

New high efficiency all-aluminum blowers with hollow shaft. Bulletin 3701.

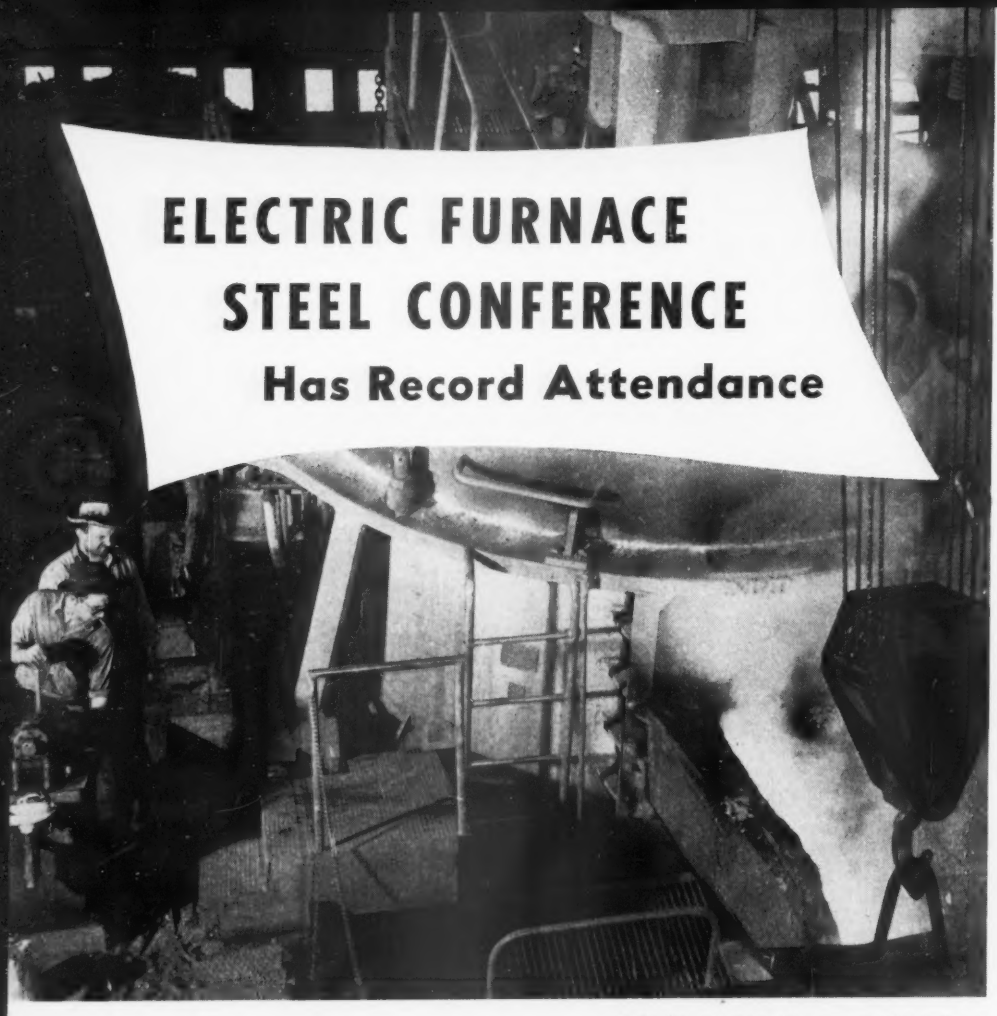


BELT-AIR FANS

Efficient, quiet wall fans for free-air delivery up to 19,000 c.f.m. Bulletin 3222-F.

ELECTRIC FURNACE STEEL CONFERENCE

Has Record Attendance



Columbia Steel Casting Co., Portland, Oreg.

By EDWIN BREMER
Metallurgical Editor
FOUNDRY

ATTENDANCE of over 600 marked the largest participation at an Electric Furnace Steel Conference since its inception in 1943. Held at Hotel William Penn, Pittsburgh, Dec. 7-9, the conference was arranged under the direction of T. J. McLoughlin, Carnegie-Illinois Steel Corp., Pittsburgh, chairman, and R. H. Frank, Bonney-Floyd Co., Columbus, O., vice chairman.

At the annual dinner Thursday night, Dec. 7, it was announced that Mr. McLoughlin had been elected chairman of the Electric Furnace Steel Committee to succeed J. A. Bowers, American Cast Iron Pipe Co., Birmingham, Ala., and that Mr. Frank had been elected chairman of the committee for the ninth annual conference to be held at Hotel William Penn, Pittsburgh, Dec. 6-8, 1951. W. M. Farnsworth, Republic Steel Corp., Massillon, O., was elected vice chairman. Norman I. Stotz, Braeburn Alloy Steel Corp., Braeburn, Pa., and a past chairman was presented a certificate in recognition of his services to the Electric Furnace Steel Committee.

At the opening session T. J. McLoughlin welcomed those attending, and J. A. Bowers made the response. First technical session on raw materials had as chairmen M. J. Meinen, Universal Cyclops Steel Corp., Bridgeville, Pa., and R. H. Frank, Bonney-Floyd Co., Columbus, O. John Arthur, Crucible Steel Co. of America, Pittsburgh, pointed out that iron ores used in electric furnace steelmaking vary considerably in analysis, and that the Lake ores are increasing in silica content, averaging at present around 7 per cent. South American ores are better in this respect, averaging about 4 per cent for combined silica and alumina. He believes that in the future beneficiated taconite ores will be more uniform in composition.

A. K. Blough, Republic Steel Corp., Canton, O., stated that he preferred sinter and roll scale to iron ore, and mentioned that African ores appeared even better than South American ores, but are not yet available in any quantity. J. S. Marsh, Bethlehem Steel Co., Bethlehem, Pa., commented on the difficulty in securing foreign ores during wartime periods, and also the wide variations in compositions of available ores.

In a discussion on "Scrap—Availability, Present Physical Condition, Contamination," R. J. McCurdy, and Ralph W. Farley, Republic Steel Corp., Chicago, pointed out that full development of the electric furnace as a producer of other than alloy steels largely is dependent upon scrap. Hence, constant vigilance must be exerted to maintain scrap quality by proper segregation—removal of nonferrous materials, and separation according to types of steel. Accomplishment of those ends is by education of scrap suppliers as well as plant workers. J. J. Green, Cyclops Steel Corp., Bridgeville, Pa., suggested that scrap suppliers check more carefully on size of scrap, make a better separation of steel according to type, and do a better job of bundling or packing. Ray Bromley, M. E. Solomon Co., Pittsburgh, stated that scrap suppliers in general are endeavoring to meet requirements on scrap quality, and always are willing to co-operate in maintaining that state of affairs.

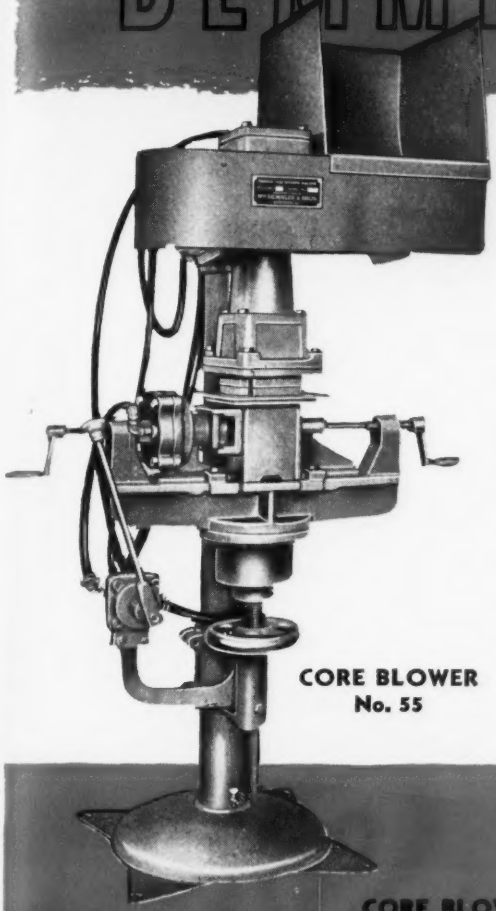
D. G. Schoffstall, Carpenter Steel Co., Reading, Pa., presented a paper prepared in co-operation with C. B. Post of the same firm on "Slag Materials and Slag Action in Basic Arc Furnaces" which stated that the best grade of lime free from moisture should be used. Similarly, high-grade fluorspar free from lead and tin is necessary, and the deoxidizing agents must not yield a product harmful to metal bath or physical condition of the slag. Leland Peterson, Timken Roller Bearing Co., Canton, O., pointed out that by removing the oxidizing slag, and establishing a suitable reducing slag along with the proper power input, a fairly strong carbide slag would form up in 20 to 25 minutes. Deoxidation is accomplished by using ferrosilicon in the metal bath and silicon carbide additions to the slag.

Thursday afternoon's session on oxidation practice with acid electric furnaces was presided over by C. W. Briggs, Steel Founders' Society of America, Cleveland, and related to ore, and oxygen practice. F. J. Stanley, McConway & Torley Corp., Pittsburgh, and W. L. Doyle, Pittsburgh Steel Foundry Corp., McKeesport, Pa., discussed use of ore. Mr. Stanley said his practice is to use about 240 lb of ore with 12-ton charges. The carbon drop during the boil ranges from 0.036 to 0.093 with an average of 0.064 per cent per minute. Kilowatt consumption per ton ranges from 460 to 470.

(*Continued on page* 201)

DEMMLER

HIGH PRODUCTION WITH *Maximum Economy!*



CORE BLOWER
No. 55

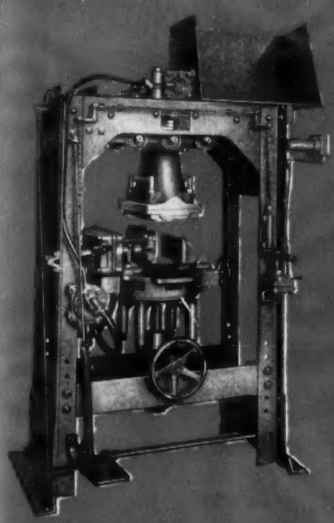
DEMMLER CORE BLOWING MACHINES

High production . . . maximum economy!

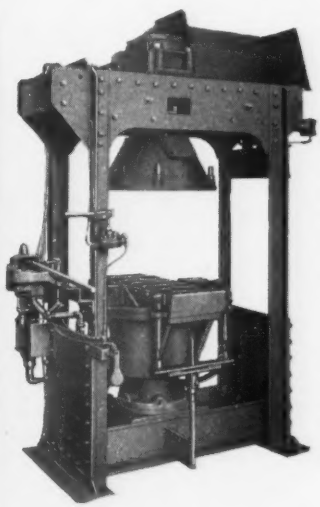
Every foundryman realizes the absolute necessity for both in these days of ever increasing production costs, and that's where DEMMLER Core Blowing Machines fit into your picture! DEMMLER machines are dependable, rugged, versatile, producing economically day after day — year after year.

At the left is the popular DEMMLER No. 55, a small core blower unequaled for blowing cores up to four pounds. Will accommodate boxes 9" long. Sand magazine and carriage are aluminum castings, mounted on ball bearing rollers for easy pushing from filling to blowing position. Machine has both vertical and horizontal air operated core box clamps, controlled automatically by the same valve that blows the core. Ideal for short run jobs. Simple in construction . . . simple in operation, the DEMMLER No. 55 has earned the praise of foundrymen everywhere.

CORE BLOWER No. 1



Well known and liked by foundrymen is the DEMMLER No. 1, at left. This is a general purpose machine for blowing cores weighing up to eight pounds, such as plumbing goods, electrical fittings up to 1½", and various small brass, malleable and grey iron castings. The No. 1 possesses quick job changing features. Chuck table is raised and lowered by a hand wheel. Chuck jaws are easily adjusted for different core box widths. Will blow either horizontal or vertical. Different size sand magazines available. Capacity: approx. 200 core boxes per hour. Many have been in continuous, profitable use for more than 25 years with only minor repairs!



CORE BLOWER No. 3E

The DEMMLER No. 3E core blower, at left, has gained an enviable reputation as a highly efficient machine for use on large cores which can be blown to advantage by attaching the top half of the core box to the blow plate and drawing the core on the machine.

An important feature of this machine is that the table height is adjustable by means of the large nut on the base, so that only as much draw is used as required.

The No. 3E is outstanding for automobile work and similar castings. The cylinder has a long center guide stem which slides in a sleeve, to insure a draw of extreme accuracy. Two hand valves operate the machine — one moves the carriage from filling to blowing position, the other raises the table, blows and draws the core. Time cycle is about 12 seconds.

Draw cylinder is 17 inches in diameter, has 10 inch stroke. Will blow cores weighing up to 35 lbs. Here is a large capacity, high production core blower with draw cylinder feature that is unexcelled in its field.

There is a DEMMLER Core Blower to meet every requirement. Let us help you with your particular needs. Illustrated specification sheets on any of the three Core Blowers will be sent upon request.

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KEWANEE, ILLINOIS

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INDUCTION HEATING CORP. NEW YORK

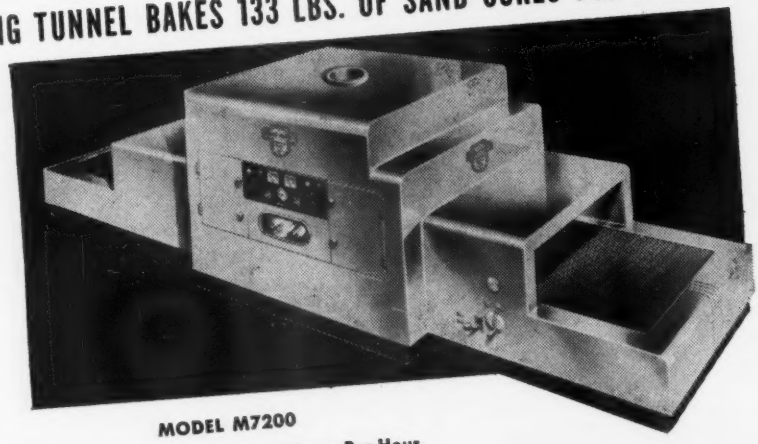
NEW DEVELOPMENTS IN ELECTRONIC HEATING!

ENTIRE ONE-MAN CORE ROOM OPERATION NOW POSSIBLE WITH NEW CORE BAKING TURNTABLE!

Ther-monic Model 300-T bakes 400 to 500 lbs. of sand cores per hour . . . depending on their moisture content. Core blowers, rollover machines and benches can be placed adjacent to the turntable. One man can load and unload the cores from the turntable, remove the baked cores from the driers or core plates and immediately re-use them. Baked cores require no cooling-off period. Space-consuming cooling and storage racks are eliminated.

NEW THER-MONIC CORE BAKING TUNNEL BAKES 133 LBS. OF SAND CORES PER MINUTE, FROM START TO FINISH!

The Ther-monic core baking process makes it possible to reduce handling and breakage. Cores up to 20" x 60" in any length are baked evenly throughout, with no green centers. The Ther-monic process achieves a finer core finish, eliminates over-baked and burned surfaces. No cooling period is required . . cores, after leaving tunnel, are immediately ready for inspection and use. Ther-monic baked cores are highly resistant to cracking during the pouring operation—reduce finning to a negligible factor. Write for complete details!



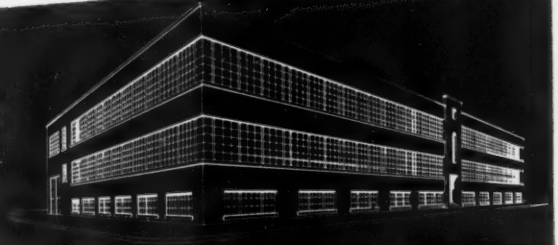
MODEL M7200

Capacity: Four Tons of Sand Cores Per Hour

Overall dimensions of Conveyor and Electrode Housing: 8' x 8' x 32'

INDUCTION HEATING CORPORATION

181 WYTHE AVE., BROOKLYN 11, N.Y.



(*Continued from page* 198)

Relative to use of oxygen, R. H. Jacoby, Key Co., East St. Louis, Ill., stated that in a study of over 4000 heats covering plain carbon as well as alloy steel for castings, about 380 cu ft of oxygen are required to remove 10 points (0.10 per cent) carbon. In practice at his plant the oxygen is admitted at a pressure of 60 psi through a ⅜-in. lance for 2 to 3 minutes. Time of admission is when the temperature of the bath is such that the boil is incipient.

J. H. Garrison, Oklahoma Steel Castings Co. Inc., Tulsa, Okla., said his practice is to add 1.3 per cent ore and 0.15 per cent carbon in the form of carbon electrode turnings with the cold metal charge. Oxygen is admitted to the charge just as it begins to boil as indicated by sudden surging of the ammeter connected into the primary circuit. About 450 cu ft of oxygen are used to reduce the carbon from 0.38 to 0.195 per cent at the rate of 4 points (0.04 per cent) a minute.

Discuss Special Deoxidizers

Friday morning's session, under the direction of C. E. Sims, Battelle Memorial Institute, Columbus, O., and R. H. Jacoby, dealt with experience with special deoxidizers. First paper by C. G. Mickelson, American Steel Foundries, East Chicago, Ind., gave results obtained in a study of use of selenium, a 6 per cent Ca-50 per cent Si-10 per cent Ti alloy, a 40 per cent Si-7.5 per cent Mg-3.5 per cent Al alloy, and metallic sodium. Good results were obtained with 0.075 to 0.10 per cent Se with 1½ lb Al per ton. Likewise good results were obtained with 3 lb of the Ca-Si-Ti alloy and ⅝-lb Al per ton addition. Due to the higher residual Si in acid electric steel practice it was found that the Si-Mg-Al was not satisfactory, but would be in basic practice where residual Si is lower. Addition of metallic sodium appears to have considerable promise, but further investigation is necessary to obtain consistent results.

Clyde Wyman, Burnside Steel Foundry Co., Chicago, presented numerous graphs and illustrations showing the effect of various deoxidation treatments on type of inclusion and properties of Class B steels. J. A. Bowers, American Cast Iron Pipe Co., Birmingham, Ala., described use of silicon as a deoxidizer to eliminate pinhole porosity. In carbon steel containing 0.15 per cent C, 0.40 to 1.50 per cent Si gives sound castings, while with 0.50 per cent C, the Si required is 1.10 to 2.20 per cent. A paper by W. O.

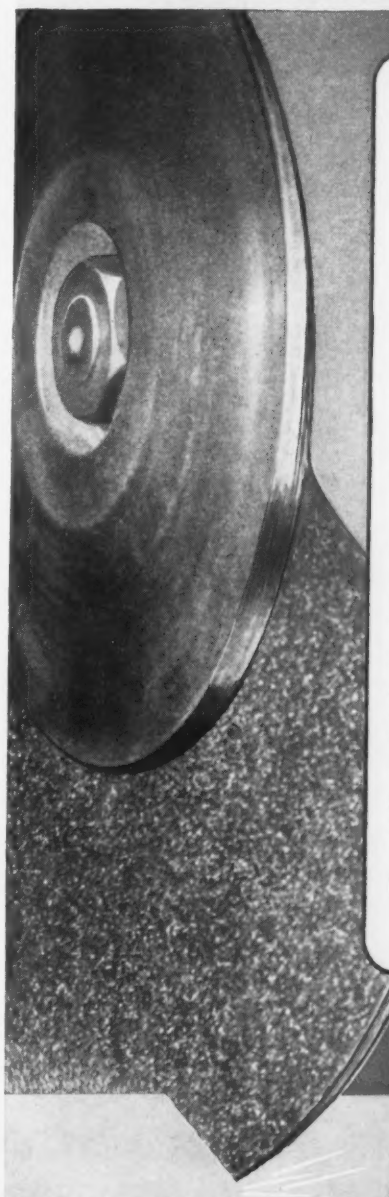
(*Concluded on page* 204)

Electro

Electro SINCE 1919

9500 Cuts On ¼" Alloy Valve Stock With

Electro's NEW CUTRITE CUT-OFF WHEELS



No time now for delays, waste or faulty production even in preparatory work!

Here's Electro with a *new* cut-off wheel of *proved* superiority in performance and durability. Think what these performance records mean to you . . .

2" x 1¾" risers cut on nickel-iron castings in 16 seconds! 9500 cuts on ¼" alloy valve stock. No binding or breakage on 5½" x 2½" heavy, stainless, alloy steel castings which are normally burned. 46.6% longer service than the average of competitive wheels on 1" stainless, low carbon, beryllium copper, silicon bronze and manganese bronze stock; and outlived and outperformed competitive wheels on 15/32" carbon steel, drill bit rod.

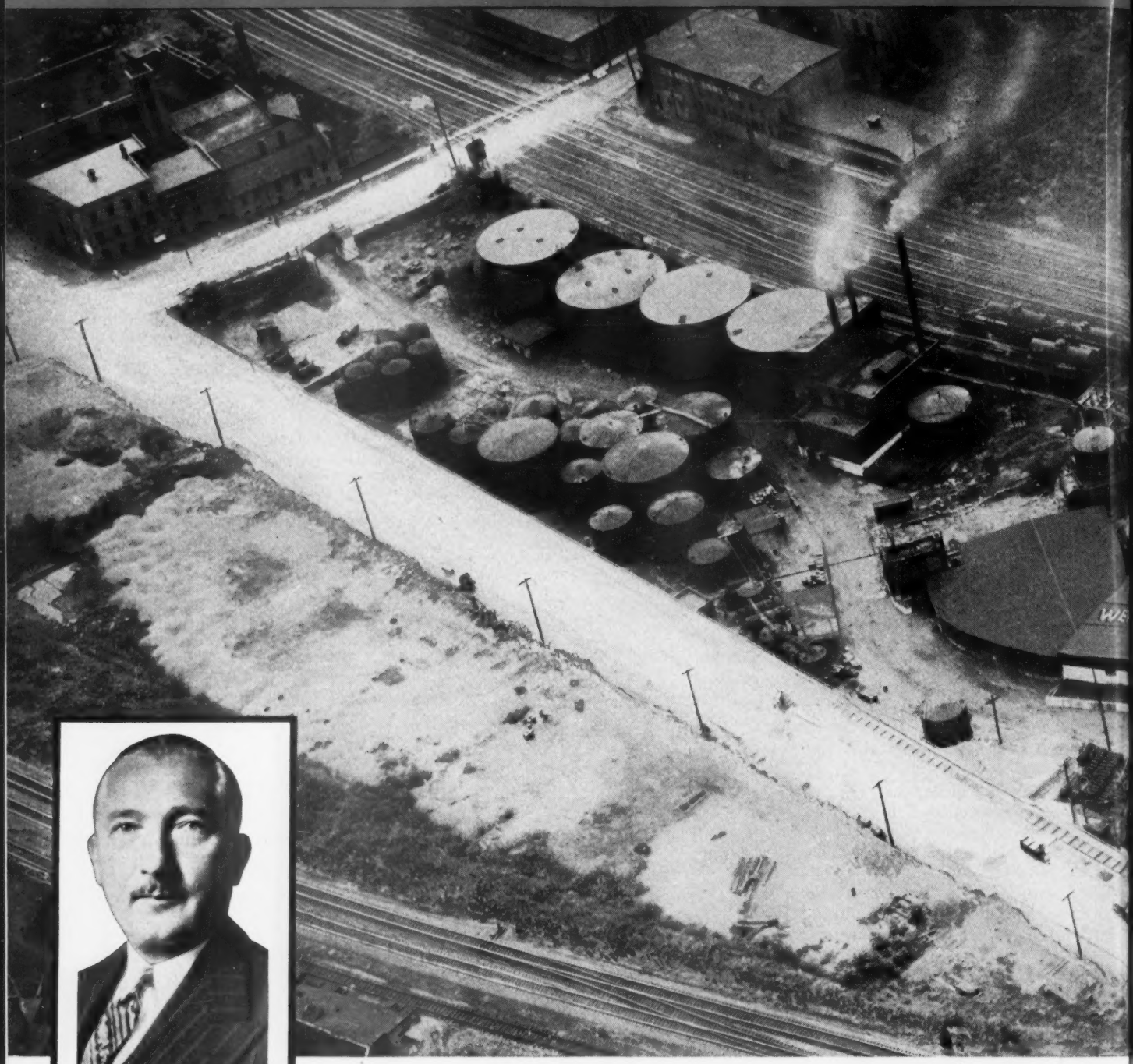
ELECTRO REFRACTORIES AND ALLOYS CORPORATION
344 Delaware Ave., Buffalo 2, N. Y.
West Coast Warehouse . . . Los Angeles
Canadian Electric Furnace Plant, P. Q.

Write, wire or *phone*. We'll get a Field Engineer to you quick to prove these new wheels on *your* job. The same research skill and engineering competence that produced these new wheels are at your command upon request for cooperation on rough operations like snagging, or precision work like roll grinding.

Electro HIGH-SPEED GRINDING WHEELS

STRONG • SAFE • EFFICIENT

Here's Our Plant Now Making



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President

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New Werner G. Smith Core Oils

Our new Cleveland, Ohio, core oil manufacturing plant has all the modern facilities needed to make the finest quality core oils of Werner G. Smith's years of formulating experience.

Here Werner G. Smith's 35 years of practical knowledge of core oil manufacture are backed to best advantage in our 51-tank plant—three private rail sidings, quality control laboratory, warehouse, mixing tanks, etc., provide all the modern manufacturing facilities to assure dependable supply to the largest foundries and fast delivery service to the smallest foundry.

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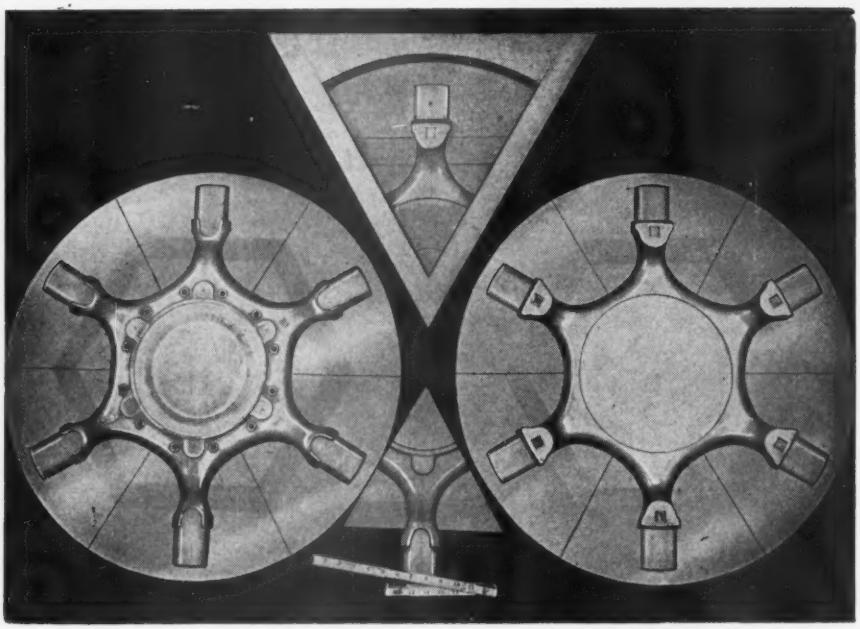
PROFIT BY OUR MANY YEARS OF EXPERIENCE



Cope and drag equipment for truck wheel, made from one spoke (1/6) of wheel.

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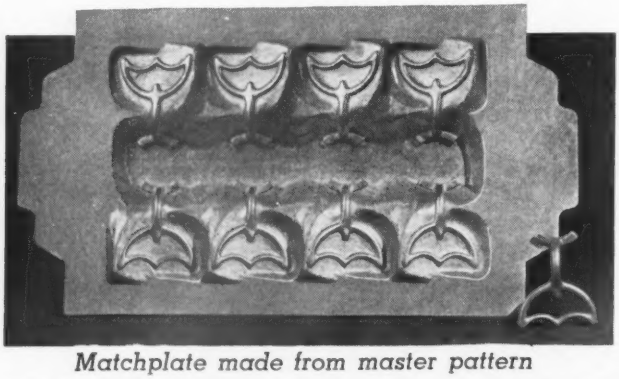
Only one master pattern does it! From it we make you single or multiple pattern matchplates, casting them under pressure in plaster molds. Why not find out exactly how much we can save you by this method, or by furnishing cope and drag plates which likewise jump production and lower your costs? Write us for quotations now.



Matchplate made from master pattern

PLASTER PROCESS CASTINGS COMPANY

6922 Carnegie Avenue Cleveland 3, Ohio

(Toledo Matchplate Co., Toledo 2, Ohio, Affiliated)

Pressure-Cast MATCHPLATES

COPE and DRAG PLATES

(*Concluded from page* 201)

Igelman and D. A. Finch, National Malleable & Steel Castings Co., Melrose Park, Ill., and presented by Mr. Igelman, described the use of 6 lb of an alloy containing 15 to 21 per cent Ti, 1 to 2 per cent B, 2 to 4 per cent Si, 1 to 2 per cent Al with 3 lb Ca-Si per ton which resulted in reduction of costs in the melting and heat treating departments.

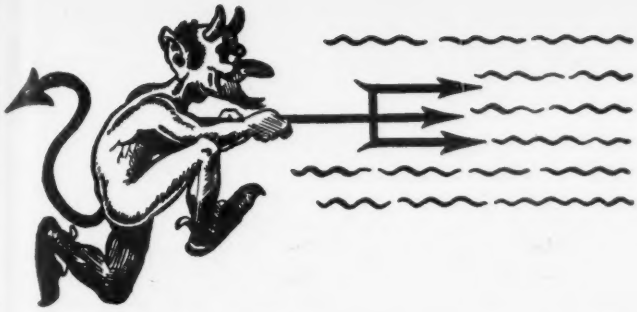
Afternoon session, with Victor E. Zang, Unitcast Corp., Toledo, and H. H. Blosjo, Minneapolis Electric Steel Casting Co., Minneapolis, presiding, was concerned with production control of molten steel temperature and its effect on steel casting quality. Charles A. Faist, Burnside Steel Foundry Co., Chicago, described the procedure developed in his foundry for temperature determination, and stated that temperature control of the heats resulted in steel castings having a better surface finish and physical properties. Others participating in the discussion included G. A. Lillieqvist, American Steel Foundries, East Chicago, Ind.; E. H. Berry, Dodge Steel Co., Philadelphia; Warren Hart, Ford Motor Co., Dearborn, Mich.; H. H. Johnson, National Malleable & Steel Castings Co., Sharon, Pa., and James A. Bowers.

Experts Supplied Answers

Chairmen at the educational session Saturday morning were H. E. Phelps, Rotary Electric Steel Co., Detroit, and C. H. Lorig, Battelle Memorial Institute, Columbus, O. Session was opened with a motion picture "Alloy Steels—A Picture of Controlled Production." J. S. Marsh, Bethlehem Steel Co., Bethlehem, Pa., spoke briefly on "Effect of Residuals and Their Removal." Then followed a "Question Period" with a panel of experts to supply the answers.

The latter included the chairmen; J. H. Eisaman, Carnegie-Illinois Steel Corp., Chicago; H. H. Blosjo, Minneapolis Electric Steel Castings Co., Minneapolis; W. S. Debenham, Carnegie-Illinois Steel Corp., Pittsburgh; Samuel Arnold III, Pittsburgh, and Gerhard Derge, Carnegie Institute of Technology, Pittsburgh. Topics considered included manufacture of 0.03 per cent C stainless steel; use of stainless steel grindings; cause of pinholes in steel castings; use of Mg as a desulphurizer for steel; pressure of oxygen in carbon removal from molten steel, and elimination of hydrogen from steel.

H. L. Harville Mfg. Co., P. O. Box 177, Corona, Calif., suffered fire damage in its diecasting department Jan. 5.



Soffel's

Exothermic CARBON FREE Liquidizer

KEEPS FEEDING METAL MOLTEN 50% LONGER

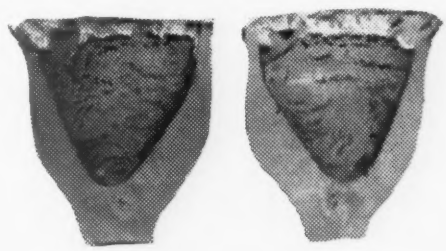
SOFFEL'S EXOTHERMIC CARBON FREE LIQUIDIZER is the leader in major foundries for use on ferrous and non-ferrous metals, and in ingot production. It is the first and the original scientific non-carbon exothermic compound for feeding heads and risers.

SOFFEL'S EXOTHERMIC CARBON FREE LIQUIDIZER is different from ordinary head compounds in two ways: It is CARBON FREE, thereby eliminating carbon pick-up. It is EXOTHERMIC. Carbonaceous materials, regardless of their composition, will cause carbon pick-up, segregation, non-uniform grain structure and hard spots under risers and in castings. Carbonaceous materials contribute no added heat value or increased temperatures to the feeding metal and only act as an insulating cover.

NOTE THESE TYPICAL RESULTS FROM THE USE OF SOFFEL'S CARBON FREE LIQUIDIZER

This six inch by six inch chrome-nickel-steel riser, with the application of 1 pound of SOFFEL'S CARBON FREE LIQUIDIZER, the average weight was reduced from 32 pounds to 13 pounds, a savings of 19 pounds of saleable metal which normally would have been discarded as scrap, but which was fed into the casting and produced a heavier, sounder casting. Note the feeding head can be knocked off easily saving burning costs. There is no better feeding head compound at any price than SOFFEL'S CARBON FREE LIQUIDIZER.

SOFFEL'S EXOTHERMIC CARBON FREE LIQUIDIZER reacts within itself exothermically, producing a temperature above 3200° F. actually increasing the temperature of the feeding metal to a point well above that of the metal in the main body of the casting, thus ensuring that the feeding metal will be the last to freeze. Shrink cavities in the casting caused by premature freezing of the feeding metal are eliminated. After the exothermic action has ceased, the LIQUIDIZER forms a soft insulating blanket on the metal. This confines the heat generated by the LIQUIDIZER and aids in maintaining the desired high temperature of the feeding metal in the heads.



Soffel's Thermotomic Compound

for all metals and alloys

Patented

SOFFEL'S THERMOTOMIC COMPOUND is an exothermic molding compound which is molded and baked into any desired shapes just as sand cores are made. It is used as ring inserts under the risers or feeding heads and blind riser cracker cores. Also as a facing insert where it is desirable to maintain the fluidity of metal in the mold at those points where rapid cooling may cause piping, shrinkage or segregation. It produces a temperature up to 3500° F. Great savings are realized through the reduction in height of risers as well as the cost of removing feeding heads. SOFFEL'S CARBON FREE LIQUIDIZER should be used on top of the feeding heads in conjunction with the use of SOFFEL'S THERMOTOMIC COMPOUND. For aluminum and magnesium THERMOTOMIC ABC and AL-X31 LIQUIDIZER on top of the heads is recommended. Write for descriptive literature.

BEWARE OF IMITATIONS! We are the originators of CARBON FREE LIQUIDIZER and THERMOTOMIC COMPOUNDS

Pittsburgh Metals Purifying Company

WORLD'S LARGEST MANUFACTURERS OF FLUXES AND PURIFIERS FOR ALL METALS AND ALLOYS

1352 MARVISTA ST., N.S. **PITTSBURGH 12, PA.**

Adventures of BILL

By PAT DWYER
Illustrations by RICHEY

SOMETIMES," Bill said the other night, "I wonder if the human race, taking it by and large, as the saying goes, up and down, catty corner and down the center, individually and collectively, is as smart and clever as it or they thinks it is or are."

"Come again. It may be that I am not as sharp on the pickup as I might be, but with all due deference to a guest, and exercising the broadest and most Christian charity I find the greatest difficulty in disentangling that statement. I doubt very much that even old Gimlet Eye—a teacher I cordially disliked in my young days—I doubt even he could parse and analyze it."

"No person asked you to parse or analyze it. So far as I know no attempt was made to persuade you to take it home and practice it on a key bugle. Language, my dear young fella, was invented and developed to facilitate communication between human beings. The form in which a message is delivered is only an incidental feature, so long as the party of the second part gets the meaning. A message may be delivered to you in the form of a scented note on a silver platter, or it may come in the shape of a piece of soiled paper wrapped around a stone and thrown through a window pane. Result in both cases is exactly alike."

"What has all that rigmarole got to do with the dumbness of the human race?"

"So you caught the drift of my remark, hey? If you had not been in such a hurry to hear the music of your own voice, I intended to dip a little deeper in the subject. If the human race was not so dumb, it would have found a way long ago to harness the rays of the sun in the summer. Store all the wasted heat and energy and then release the same heat and energy in the winter where and when the treatment would do the most good, and where and when the treatment would be deeply appreciated.

"Reference to the sun and heat and all that there kind of stuff reminds me of a poem presented to me some time ago by a solid citizen. In his young harum-scarum days he had been a follower of Black Jack Pershing, when that dashing soldier was engaged in some slight bickering with Pancho Villa on and around the Mexican border. With your kind attention and reasonable forbearance I'll read it to you. This version is in prose form:

Originally the devil in hell was chained, and for thousands of years he there remained. He often complained and was heard to groan that he wanted to start a hell of his own. So he asked the Lord if He had on hand anything left over when He made the land. The Lord said yes, He had some on hand, left down in Texas near the Rio Grande. Horny gandered down to look at the truck, but even as a gift he knew he was stuck. Sand was crawling with millions of fleas; horns on the toads and thorns on the trees. Thermometer in summer showed a hundred and twenty-twenty. 'Me for home' says the old boy. 'Too much is plenty!'

"Some of these soldier lads," I admitted, "display a happy gift in describing camp life. They touch the top of the form when engaged in airing a gripe. It is to be regretted that the free and easy camp vocabulary does not lend itself to reproduction in printed form except in the highest class books and periodicals. Fortunately, these are beyond the reach of the ordinary reader, sometimes known as the man in the street. This wise provision by those who establish, maintain and enforce our moral standards, prevents the spread of contagion, especially among all those under five and over one hundred.

"During the recent war I had occasion to read several ferocious specimens of literature in prose and verse form. I have none at the moment with which to regale you—"

"Don't let that weigh upon your conscience." Bill snapped his fingers in airy dismissal. "I probably saw and read them all about the same time you did. If I never see or hear of them again, it will be too soon. At the time and place they were interesting in that they reflected the spirit and attitude of our fighting men all over the world, but, as I always say, there is a time and place for everything."

"Well," I said, "Here is your chance to say it again. This is the time and place for me to spill into your eager ears, the story of a 1000-ton steel casting."

"If it is all the same to you, and of course meaning no offense," Bill sat up in his chair like a jack-in-the-box, "you can tell that to the Marines, the Argentines, the Portuguese

(*Continued on page* 208)

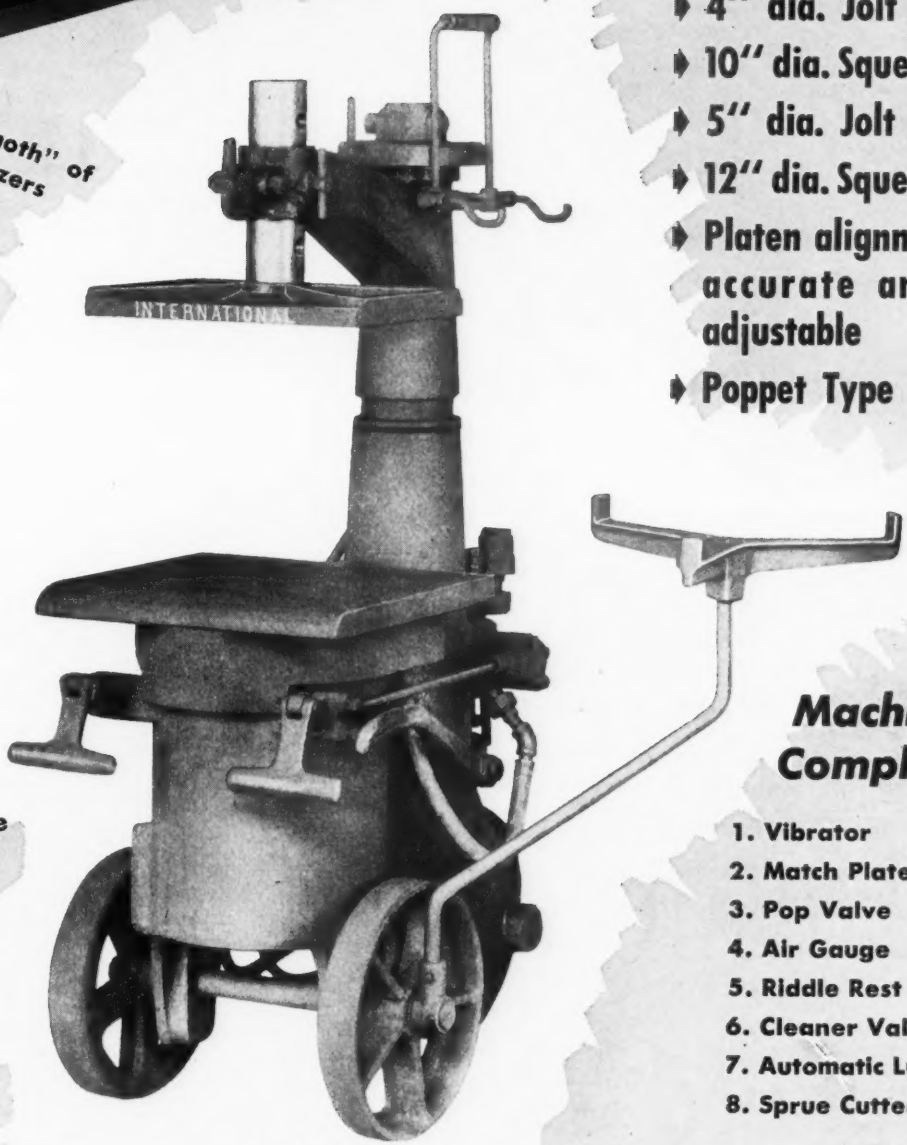
No, Percy. Not the rat-tat-tat THING from Tin Pan Alley

Immediate Delivery!

INTERNATIONAL
TYPE LJS
JOLT SQUEEZERS

- Portable or Stationary
- 4" dia. Jolt Cylinder
- 10" dia. Squeeze Cylinder
- 5" dia. Jolt Cylinder
- 12" dia. Squeeze Cylinder
- Platen alignment always accurate and quickly adjustable
- Poppet Type Valves

The "Behemoth" of Jolt Squeezers



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Long-lasting because of Sturdy Construction - extra heavy weight

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we start by asking "what"

WHAT are *your* problems? Under WHAT conditions will *your* crane be operated—intermittently, or under fairly constant conditions? WHAT are the operating speeds necessary to meet *your* productive cycle?

Your answer to these and similar questions will enable us to engineer your installation so that it will give you the best, and longest service—at the lowest cost per load over the years.

Be sure you get the crane best qualified to do *your* job. It's wise—and costs you nothing—to get the facts first, rather than to make expensive changes later.

May we place our experience of a great many years of successfully designing all types of crane installations at your disposal?

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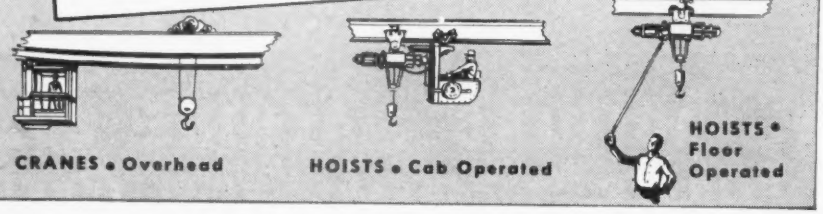


360 SCHUYLER AVENUE • MONTOUR FALLS, N. Y.

(*Continued from page* 206)

and the Greeks, but don't waste your time telling me about a 1000-ton steel casting. There ain't no such animal. Never was, is not now and it is reasonable to assume there never will be. I'm as willing as the next fella to listen to any kind of a story on a foundry subject. But, I warn, there is a limit. I can be pushed just so far."

"Call off your dog while I lay out some correspondence on the subject. My reaction was similar to yours when I read the first reference to this huge casting. At a foundry convention in England one of the speakers presented a paper covering the growth and development of the foundry industry from ancient times and down to the present. One statment was to the effect that a 1000-ton steel anvil base had been cast by a prominent steel firm in Italy. Natural professional curiosity prompted me to write to the author of the paper:

With a great deal of interest I read your Edward William's lecture "Metal Founding Through The Ages" as delivered at Cheltenham, and later incorporated in the *Proceedings* of the Institute of British Foundrymen. One minor item aroused my curiosity. Three lines above the bottom of the second paragraph, page A.27, the statement appears that a steel anvil base weighing 1000 tons had been cast at Terni in Italy.

At one time or another I have seen some large steel castings and even had a hand in the construction of several, but of a certainty I never have seen, heard, read or even dreamed of a 1000-ton casting. I am willing to admit the job might have been handled in the owld sod by Hugh of the Red Hand, or Brian Boru, but I cannot visualize a job of that magnitude in any modern European foundry. Now that the Cheltenham atmosphere, and—er—one thing and another have faded away, I wonder if you would consider sticking a decimal point somewhere among the noughts, where it would do some good.

This comment is not prompted by a critical attitude. I admired your interesting and scholarly presentation. The comment is prompted solely by foundry curiosity. I cannot conceive how any present-day foundry could handle a job of that kind. Even in the remote possibility that suitable cranes, ladles and furnaces were available, there still remains the problem of lifting, turning over, and cleaning the casting, and later the railroad equipment for conveying it to its destination. And finally in the names of Atlas, and Hercules, champion weight lifters, what kind of a customer would or could need an anvil base weighing 1000 tons?

"To this inquiry, the author of the paper courteously replied:"

Regarding the 1000-ton steel casting mentioned in my paper, the information came from a book entitled *Ironwork Part* 1, published in London 1927 by the Victoria and Albert Museum. On page 19 of this booklet it

is stated that this single steel casting was made at the works in Terni in Italy. While in Milan last year I discussed this point with several engineers. Although they were not definite, one member admitted that he had heard of the production of this casting. What they did with it I do not know.

"So that is the end of the story," Bill commented, "and we are as far ahead as we were at the beginning."

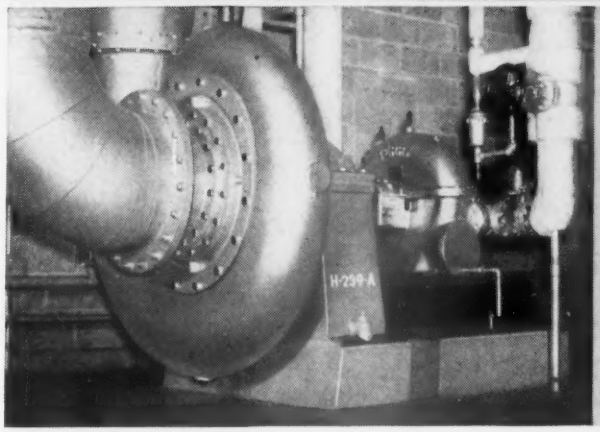
"Patience my boy. 'Tis a great virtue. Did you ever hear of the old owl who lived in an oak. The more he heard the less he spoke. The less he spoke the more he heard. Now children all together—WASN'T HE THE WISE OLD BIRD?

"Having set my hand to the plow, in a manner of speaking, I decided to try another long-distance shot. I wrote to Terni Societa Per L'Industria E L'Electtricita:

In a paper recently presented before the Institute of British Foundrymen, a speaker stated that a steel anvil base weighing 1000 tons had been cast at a steel plant in Terni. This is so widely at variance with all our knowledge and experience of steel foundry practice, that we shall greatly appreciate your kindness and courtesy in affirming or denying the statement. In the event the statement is true, we shall be greatly interested in learning how this huge amount of metal was melted, transported and poured. Later how the immense casting was lifted from the mold and shipped to its destination. If the material is available, text and illustration, and with your gracious permission, we should be highly pleased to present the story in a future issue of FOUNDRY.

"Give me two guesses," Bill said. "1—You never had an answer. 2—You had an answer, but it was in Italian, politely and diplomatically worded, and with any reference to the anvil base carefully avoided. How is this for a free translation: This will acknowledge with thanks receipt of your recent valued communication. Always glad to hear from friends in the metallurgical field. Just now I am planning a tour of metalworking establishments in America. I shall be accompanied by my first and second helper, and we shall do ourselves the pleasure of calling on you. Yours very truly. P.S. How are the Missus and the kids?"

"Bill," I said, "as a true friend I should advise you as strongly as possible to avoid all guessing games and quiz programs, horse races and weather bureaus, any and all contests in the political arena. In a word and not to put too fine a point on it, kindly lay off the guessing game. Your batting average is zero, and you could put your total score in your eye without impairing the vision. I had a prompt and courteous reply from a gentleman connected with Terni So-



CENTRIFUGAL

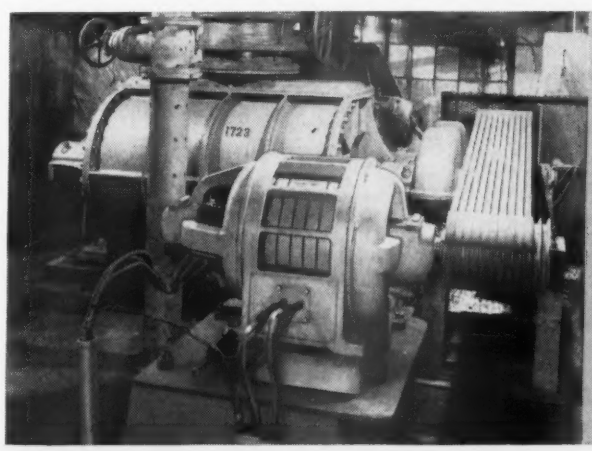
Type OIB Centrifugal Blower used for processing in a large eastern plant. Capacity 12,000 cfm. Similar R-C Blowers are utilized in other plants of this company.

The works manager of a large plant made this friendly statement to a Roots-Connersville representative. What he really meant was that R-C Blowers and related equipment perform so satisfactorily and dependably that they seldom need anything more than routine inspection by his own men.

In large and small plants, in every industry, R-C products uniformly give this kind of reliable operation. They continue to deliver rated capacities, year after year, with a minimum of maintenance—whether a small Rotary Positive Blower of 5 cfm capacity or a Centrifugal unit moving up to 100,000 cfm. And remember, only Roots-Connersville gives you this important dual-choice.

If you are planning a new plant, expansion, or replacements, R-C engineers will work with you to select the equipment best fitted to your needs. Almost a century of experience is at your service.

ROOTS-CONNERSVILLE BLOWER CORPORATION
510 Madison Avenue, Connersville, Indiana



ROTARY

After 20 years of continuous foundry cupola service, an old R-C Blower was released for intermittent service and replaced with this modern, Type RCS Rotary Positive unit, with capacity of 10,200 cfm.

ROOTS-CONNERSVILLE

BLOWER BUILDERS SINCE 1854

ONE OF THE DRESSER INDUSTRIES

cieta Per L'Industria E L'Elettricita:

We are in receipt of your recent letter and offer the following explanation about the large steel casting to which you refer. In advance we might say the casting was gray iron and not steel. This, of course, will put a completely different face on the matter. The work executed about 1890 covers exactly the anvil base for a 100-ton hammer. This hammer and base were in constant use until 1908 when the equipment was changed to a 4500-ton hydraulic press.

The anvil base was molded in a pit in the floor and the mold was filled with successive heats from the foundry situated about 3 km away, a little over 2 miles. The anvil base was demolished in the postwar period and a reinforced concrete structure was erected in its place. In view of the fact that the anvil base was a gray iron casting, we think that a detailed description of the molding, melting and pouring practice would not be of particular interest. However, we shall be pleased to furnish any additional information you may require.

"There," I said, "could anything be fairer than that? Touching on another point in your recent guessing program, the letter was written in English."

"Well," said Bill, "I'll tell you. The mystery is pretty well cleared up by the statement that the casting was gray iron and not steel. Every foundryman knows there is quite a bit of difference between the technique involved in the production of large gray iron and large steel castings.

"Many years ago I read a description of the methods employed in casting a 600-ton gray iron anvil base in the Russian city of Odessa near the upper northwest corner of the Black Sea. The mold was made in a heavily reinforced pit in the floor, and the metal was melted in a battery of cupolas surrounding the mold. By tapping the cupolas in relays a constant stream of iron was kept flowing until the mold was filled.

"So far as I know this huge lump of iron still lies in the pit in which it was cast. It was intended for use with a great steam hammer, but a change in the personnel of the imperial council cancelled any further work on the project. Cancelling contracts is by no means a modern invention or the peculiar prerogative of the Democratic or Republican administration."

BUCKEYE
MEANS PROFITABLE
CUPOLA LININGS
TIME-TESTED.
EASILY
HANDLED.
RECOMMENDED
By FOUNDRYMEN.
LONGER
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HEAT
RESISTING.
ECONOMICAL.
CUTS
DOWNTIME.
QUICKLY
INSTALLED.
FAST DELIVERY.
Buckeye Silica Firestone keeps black figures in your ledgers. It lasts longer, cuts installation time to a minimum, does not disintegrate in high temperature areas, is easily handled and installed. It is widely used . . . is recommended by foundrymen in all parts of the country. In comparative tests with other refractory materials, Buckeye Silica Firestone comes out first as the ideal lining.
You can readily take advantage of the many exclusive features of Buckeye by writing us today. One of our engineers will gladly call at no obligation and show you how easily Buckeye can save you money as well as time and labor.
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"FOR THAT EXTRA SERVICE"
SILICA FIRESTONE

New Jersey Technical Group To Meet

First annual conference of the Technical Societies Council of New Jersey Inc. will be held in the Mosque Theatre, Newark, N. J., March 12. The technical sessions will start at 2 p.m. A dinner will be held in the evening.

Speakers at the technical sessions will be Dr. V. W. Sweeney, vice president, Standard Oil Development Co., New York, who will speak on "Modern Synthetic Fuels"; Dr. A. B. Kinzel, president, Union Carbide & Carbon Research Laboratories, New York, "Metal Problems in Combustion Engines"; and J. W. Brennan, manager, Hydraulic Coupling Division, American Blower Corp., Detroit.

Howard E. Voyt, Sterling Wheelbarrow Co., 25 West 43rd St., New York, is in charge of reservations.

Publishes Booklets

American Management Association, 330 West 42nd St., New York, has published two booklets dealing with personnel and economic problems facing management in the current mobilization period. They are "Personnel Problems Under Mobilization" and "Wage Policy and Problems in a Preparedness Economy." Each is priced at $1.25.

How To Cast a Heavy Table

(*Continued from page* 121)

between the center and the four corners of the casting as shown in Fig. 4. However, that means a considerably greater amount of metal to melt and handle and additional work involved in removing the risers from the casting. With the five risers the dimensions suggested for the single riser may be modified as shown in the sketch.

Without a knowledge of available facilities it is impossible to suggest the best and most economical method for removing the risers from the casting. They may be cut with the electric or acetylene torch, or a portable drill may be set up to bore a number of holes close together through the neck of the riser. Then a drop ball or other heavy weight suspended from the crane may be swung like a battering ram against the body of the riser.

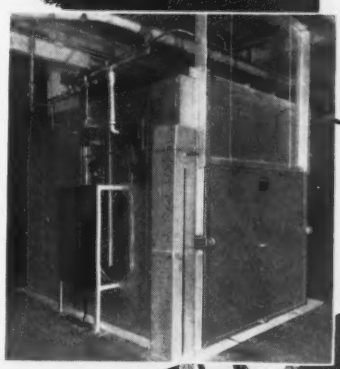
Make Vertical Mold

In a foundry where loam molding is practiced the best method for molding this type of casting is vertically in a pit. Some of the features are shown in the accompanying sketches, which are not drawn to scale. In some instances they are exaggerated for emphasis and clarity. The method presents advantages and disadvantages—a common phenomenon in the foundry—but where conditions are favorable the advantages tip the scale by a considerable majority. For example, a few straightedges and two or three simple coreboxes take the place of a huge unwieldy pattern. Risers may be reduced in size and number. Both faces of the casting will be clean. The method is particularly desirable where more than one casting is on the order book, or in prospect. With a little touching up, the original mold will serve almost indefinitely.

The mold is made up of four parts —the bottom, the sides, the ends and the cover. With the pit cleaned out, a brick foundation is built up to a height that will bring the top of the mold flush with the foundry floor. If the pit is not deep enough, the upper part of the mold may project above the floor level where it may be enclosed in a curbing in the usual manner. However, in this particular instance that feature is not recommended for a reason that will appear later. The foundation wall is covered with loam and struck off level with a straightedge. Necessary openings are provided for the cores

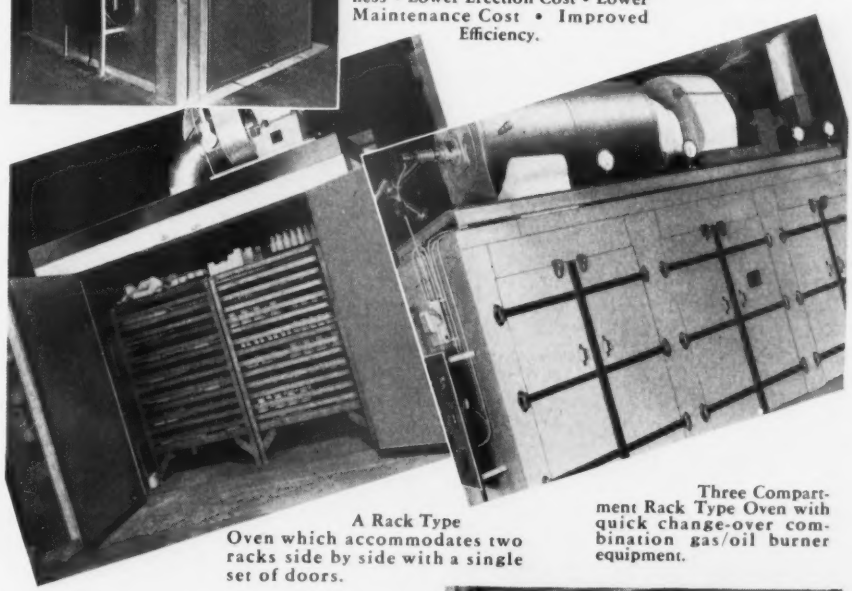
Are You Prepared for ACCELERATED Demands on your FOUNDRY?

✓CHECK OVENS by LANLY



The COMPACT ECONOMY OVEN

Built-in Air Heater • Built-in Circulating System • Elimination of Duct Insulation • Compactness • Lower Erection Cost • Lower Maintenance Cost • Improved Efficiency.



A Rack Type Oven which accommodates two racks side by side with a single set of doors.

Three Compartment Rack Type Oven with quick change-over combination gas/oil burner equipment.

LANLY FOUNDRY OVENS are available in standard units suited for the requirements of the average foundry or can be custom-designed and built for core baking, pasting and mold drying, as well as for casting conditioning and heat-treating.

Write for the Catalog.

A Two Compartment Car Type Mold Drying Oven. Each Compartment individually heated and controlled.

THE LANLY CO.
OVENS FOR INDUSTRY
HEATED BY GAS, OIL, ELECTRICITY OR STEAM
780 PROSPECT AVENUE CLEVELAND, OHIO

which form the trunnions and the side lugs. A straight wall is built up in intimate contact with one of the pit walls. This brick side wall is covered with a thickness of loam and struck off with the straightedge. A jog or gap, 2 x 12 in., is formed near each end to serve as a seat for the stop-off end cores as shown in Fig. 2. The end cores, of course, are not placed in position until after this part of the mold has been dried.

The opposite, or second, face of the mold is built on a lifting plate which may be in two or more sections. The plate is provided with a number of "dabbers," or a number of shallow flanges to hold the brick work. The plate is laid on the floor, on horses, or on the oven car, where it is filled with brick and a coating of loam is swept on the surface. This part of the mold is dried in the oven. While the mold is in process of construction the core department has built the two end cores and the covering or cope cores which may be in several sections. A rectangular sprue, 3 x 4 in., extends from the top to a point near the bottom in the center of each end core. The sprue delivers metal to the mold through four gates, 1 x 4 in., spaced as shown in Fig. 6.

With all the parts thoroughly dry, the end cores are placed in position. The second or portable side of the mold is lifted to a vertical position by the crane and lowered into place. The next step represents the most important feature in the construction of the mold. The plate is braced from the second pit wall in any convenient manner by jack screws, balks of timber, rails, steel beams, large castings or crane weights, ingot molds or roll chills. The sectional cover cores are lowered into a tapered print formed in the top of each mold side as shown in Fig. 3. Weights are employed to hold these cores in place. When the three risers on top and the pouring basins at each end are made up, the mold is ready for the metal.

Want core plates that SAVE MONEY?

. . . then use TRANSITE CORE PLATES for easy handling, low maintenance, long life!

You get real long term economy with Transite* Core Plates. Their initial cost is low . . . and their maintenance cost negligible. Transite Core Plates are tough and corrosion-resistant. They are made from an asbestos and cement composition by a special Johns-Manville process. They resist shock and corrosion . . . will not crack or break easily.

Here are other important reasons for using Transite Core Plates:

THEY SPEED PRODUCTION—
Transite Core Plates are easily handled. They're simple to clean, too, since core wash, sand, etc. do not adhere to them as readily as to other core plate materials.

THEY MAINTAIN ACCURACY—
Foundrymen who have used Transite Core Plates for years report minimum warpage.

For cores of large mass and small surface area, perforated Transite Core Plates are also available to eliminate green cores and reduce baking time. For full details, write Johns-Manville, Box 290, New York 16, New York.

*Reg. U. S. Pat. Off.

Johns-Manville TRANSITE CORE PLATES
Made of Asbestos

OBITUARY

ERNEST P. WAUD, chairman of the executive committee, Griffin Wheel Co., Chicago, died there Dec. 22. Mr. Waud joined the company in Denver, in 1905, was later transferred to Chicago and employed in various positions, becoming assistant treasurer in 1909, assistant to the president in 1917 and president in 1937. He served as president until 1948 when he became chairman.

* * *

J. V. Christensen, 85, former owner of the Wichita Falls Foundry & Machine Co., Wichita Falls, Tex., died at his home there Jan. 1. Mr. Christensen, a native of Copenhagen, came to America in 1895. He opened his own shop at Nacogdoches, Tex. in 1905 and established Wichita Falls Foundry in 1908, which operated a branch in Fort Worth, Tex. from 1921 to 1925. He retired in 1945.

* * *

Milton A. Carlson, 45, president-superintendent, Fresno Brass Works Inc., Fresno, Calif., died there Dec. 23. A founder of the company, he had been engaged in brass foundry work for 25 years. He was formerly superintendent, Western Brass Works, Los Angeles, and Berkeley Brass Works, Berkeley, Calif.

* * *

Dr. George H. Zirker, 53, foundry consultant and metallurgist, died Dec. 5 in New York.

Dr. Zirker, a graduate of Technical Academy, Zurich, Switzerland, from 1920 to 1950 served as foundry consultant and metallurgist for Carnegie-Illinois Steel Corp., Johnstown, Pa., the former Permanente Metals

Corp., Oakland, Calif., and Taylor & Co., Brooklyn, N. Y. More recently he was chief metallurgist, Burndy Engineering Co., New York, maker of electrical connectors.

* * *

Tilden B. Anstine, 73, general superintendent, Motor & Machinery Castings Co., Detroit, died Dec. 15 following 25 years with the company. Mr. Anstine was previously associated with Detroit Foundry Co., Michigan Gray Iron Foundry Co., and R. E. Olds Foundry, Lansing, Mich.

* * *

Ernest V. Moncrieff, 60, from 1930 to 1948 president, Swan-Finch Oil Corp., New York, died Nov. 5. Mr. Moncrieff had been associated with the company for 35 years. He was also a past president of the National Lubricating Grease Institute and had been its treasurer for 16 years.

* * *

Otto Kramer, 81, founder, Otto Kramer Brass & Aluminum Foundry, Milwaukee, died Jan. 7. Mr. Kramer established the foundry in 1912 and remained its president until he retired in 1947. His son, Burton Kramer, continues the business.

* * *

Kenneth A. Zahner, vice president, W. S. Tyler Co., Cleveland, died Nov. 7. Mr. Zahner, associated with the company 27 years, became vice president in charge of production in 1943, and a director a few years later.

* * *

A. H. Woodward, 74, chairman of the board of directors, Woodward Iron Co., Birmingham, and vice chairman of the board, Wheeling Steel Corp., Wheeling, W. Va., died Nov. 23.

* * *

William S. Shipley, 71, board chairman, York Corp., York, Pa., maker of industrial refrigeration and air conditioning machinery, died Jan. 14.

* * *

John F. McCormack, 67, formerly manager, United Engineering & Foundry Co., Vandergrift, Pa., died Jan. 5, in Mercy Hospital, Pittsburgh.

* * *

Charles H. Cannon, 61, vice president and treasurer, Michiana Products Corp., Michigan City, Ind., died suddenly in that city Dec. 26.

* * *

James T. Jackson, president, Mid-West Abrasive Co., Owosso, Mich., died Dec. 22, as the result of an automobile accident.

* * *

G. Walter Sanborn, vice president in charge of purchasing and traffic, United Engineering & Foundry Co., Pittsburgh, died Dec. 15. Mr. Sanborn joined William Tod Co., Youngstown, O., in 1902 and remained when it was merged with United Engineering, in 1917.

* * *

Elmer S. Ward, assistant treasurer, United Engineering & Foundry Co., Pittsburgh, died Nov. 6.

* * *

Edward W. Swiess, 49, sales engineer, Industrial Pattern Works, Chicago, died there Dec. 1. Mr. Swiess, who joined the company over 7 years ago, was previously associated with Howard Foundry Co., Chicago, and Bohn Aluminum & Brass Corp., Adrian, Mich.

* * *

John C. Rohleder, 60, president-treasurer, Watervliet Iron & Brass Foundry Inc., Watervliet, N. Y., died Dec. 25, in Loudonville, N. Y.

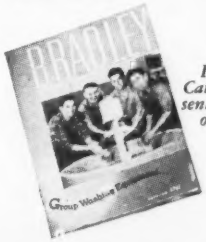
* * *

Robert L. Hannan, 34, sales representative, Beardsley & Piper Division of Pettibone Mulliken Corp., Chicago, died Jan. 5 when a private plane in which he was a passenger crashed

Where space is limited, Bradley semi-circular Washfountains will meet requirements. Each serves 4 to 6 persons. Foot-control and self-rinsing bowl provide the utmost in sanitation and prevent water waste.

● The Bradleyman draws upon the experience gained by serving an ever-widening group of Bradley users for over 30 years. His practical suggestions for washroom layouts and use of Bradley group-washing fixtures can help you find the most economical way to provide adequate facilities in a minimum of space.

Bradley 54" Washfountains accommodate 8 to 10 persons simultaneously—replace 8 to 10 single-person basins. Piping connections are reduced 80% and one sprayhead replaces as many as 20 faucets. Maintenance and water consumption are reduced sharply. Foot-control stops contagious washbasin contacts and promotes a new high in employee health and safety. BRADLEY WASHFOUNTAIN CO., 2217 W. Michigan Street, Milwaukee 1, Wis.



Illustrated Catalog 4701 sent promptly on request.

BRADLEY *washfountains*

Sold Through Plumbing Wholesalers

near Palatine, Ill., while enroute from Minneapolis to Chicago. Also killed was Sheldon Piper, 35, president, Huron Machine Co., Chicago, and son of the late Walter Piper, former executive of Beardsley & Piper.

Norma Pava Inc. was incorporated recently in New York to operate a foundry, manufacture engines, and handle factory supplies. Directors are: Alexander N. Wolf, 1775 Broadway; Clara Silver, 305 West End Ave., and Marguerite Wohl, 110-10 75th Rd., Forest Hills, all of New York.

OHIO REGIONAL CONFERENCE

To Have Outstanding Speakers

AN UNUSUAL number of outstanding authorities in their respective fields are included among the speakers who will present the technical program of the fourth annual Ohio Regional Foundry Conference. The two-day meeting, sponsored by the Canton District, Central Ohio, Cincinnati, Northeastern Ohio and Toledo Chapters of the American Foundrymen's Society, will be held in Cleveland, Friday and Saturday, Mar. 9-10.

Case Institute of Technology, Cleveland, is co-operating with the host Northeastern Ohio Chapter in sponsoring the conference. All technical sessions and two luncheon meetings will be held at Case Institute, with the annual dinner scheduled for nearby Tudor Arms Hotel. Col. Jack Major, Paducah, Ky., will be the featured speaker at the dinner.

Keyed to the theme of "Basic Approaches to Foundry Problems," the 21 technical pages to be presented will cover a variety of subjects relating to patternmaking, and gray iron, malleable iron, nonferrous and steel casting practice. The keynote address Friday morning will be given by Harry W. Dietert, Detroit, on "The Basic Approach to Foundry Sand Control."

Conference chairman is S. E. Kelly, Eberhard Mfg. Co., Cleveland. Division chairmen are: Patterns—James J. Martin, Royal Pattern Works Co., Cleveland; Gray Iron—A. W. Schneble, Advance Foundry Co., Dayton; Nonferrous—Harry C. Schwab, Bunting Brass & Bronze, Toledo; Malleable—Dr. D. C. Williams, Ohio State University, Columbus; Steel—T. W. Harvey, the Pitcairn Co., Barberton.

The program follows:

Friday, Mar. 9

9 a.m.—Registration

10:30 a.m.—Opening session
Address of welcome, S. E. Kelly, Eberhard Mfg. Co. Division, Eastern Malleable Iron Co., Cleveland; address by Dr. K. H. Donaldson, Case Institute of Technology. "Basic Approach to Foundry Sand Control," by Harry W. Dietert, president, Harry W. Dietert Co., Detroit

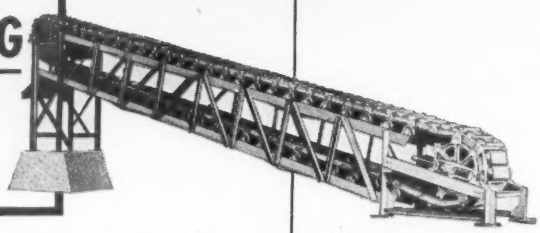
1 p.m.—Luncheon, Case Institute of Technology. Coffee talk by George K. Dreher, executive director, Foundry Educational Foundation, Cleveland

2:30 p.m.—Sectional meetings
Patternmaking Division: "Metal Spraying as It Affects the Pattern Shop," by Franz Schumacher, chief patternmaker, Cooper Alloy Foundry Co., Hillside, N. J.
Gray Iron Division: "Cupola Operation in a Permanent Mold Foundry," by H. H. Wilder, manager, Iron Foundry Division, Vanadium Corp. of America, Detroit
Nonferrous Division: "Fundamentals of Control of Nonferrous Foundry Sand," by Earl E. Woodliff, Foundry Sand Service Engineering Co., Detroit
Malleable Iron Division: "Job Shop Core Blowing," by Ralph Hasset, Texas Foundries Inc., Lufkin, Tex.
Steel Division: "Quality of Steel for Castings," by C. K. Donoho, American Cast Iron Pipe Co., Birmingham

4 p.m.—Sectional meetings
Pattern Division: "Design of Coreboxes and Driers for Use on Core Blowing Machines," by Elmer Blake, sales engineer, Osborn Mfg. Co., Cleveland
Gray Iron Division: "Shell Molding," by W. A. Geisler, research engineer, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.
Nonferrous Division: "Magnesium Foundry Technology," by W. C. Newhams, Aluminum Co. of America, Cleveland
Malleable Division: "Duplex Melting," by

Bailey

PIG CASTING MACHINE



For Ferrous and Non-Ferrous Smelters and Foundries

Ruggedly constructed for low-cost service, this machine is completely self-contained. If necessary it can be moved by crane and erected wherever needed. Once it is set in place, only an electrical connection is necessary for operation. The complete unit consists of the machine proper, motor, gear unit, variable speed reducer and drive.

CAPACITIES: 3 tons per hour to 50 tons per hour. 15 ft. to 100 ft. in multiples of 5 ft.

STATIONARY WHEEL

for Longer Service—Greater Economy

Bailey Stationary Wheel design eliminates 80% of the moving parts of the conventional type. The moulds are supported by endless chains that run on top of idler wheels which are mounted at stationary positions along the strand.

WILLIAM M. Bailey COMPANY

ENGINEERS

LEADERSHIP THROUGH QUALITY

1221 BANKSVILLE ROAD PITTSBURGH 16, PA.

Fitz Coghlin Jr., Albion Malleable Iron Co., Albion, Mich.

Steel Division: "Some Things We Know and Don't Know about Cast Steel," by C. E. Sims, Battelle Memorial Institute, Columbus, O.

6 to 7 p.m.—Cocktail hour, Tudor Arms Hotel

7:30 p.m.—Conference dinner, Tudor Arms Hotel. Col. Jack Major, Paducah, Ky., featured speaker

Saturday, Mar. 10

9:30 a.m.—Sectional meetings

Patternmaking Division: "Measurements and Their Importance to the Patternmaker," by George D. Weber, president, Weber Gage Co.

Gray Iron Division: "Basic Relations between Castings and Test Bars," by Dr. Richard A. Flinn, assistant chief metallurgist, American Brake Shoe Co., Mahwah, N. J.

Nonferrous Division: "Practical Aspects of Aluminum Melting Procedure," by William N. Brammer, Apex Smelting Co., Chicago

Malleable Division: "Uniformity Requirements of Heat Treating Furnaces," by Dr. V. Paschkis, Columbia University, New York

Steel Division: "Factors Affecting the Quality of Cast Steel," by T. N. Armstrong, International Nickel Co. Inc., New York

11 a.m.—Sectional meetings

Patternmaking Division: Subject and speaker to be announced

Gray Iron Division: "Time — the Basic Foundry Problem," by John B. Caine, technical consultant, Wyoming, O.

Nonferrous Division: "Foundry Practice for the Molding of Copper Alloys," by William B. George, R. Lavin & Sons Inc., Chicago.

Malleable Division: "Basic Approach to Malleable Refractories," by Ray Witschey, A. P. Green Fire Brick Co., Chicago

Steel Division: Subject and speaker to be announced

1 p.m.—Luncheon, Case Institute of Technology

Plan Foundry Conference At Birmingham Feb. 22-24

ANNUAL foundry practice conference of Birmingham District Chapter of the AFS will be held at the Tutwiler Hotel, Birmingham, Feb. 22-24.

On Thursday, Feb. 22, L. A. Danse, supervisor of materials and processes, General Motors Corp., Detroit, will speak on "Foundry Developments as General Motors Sees Them." Also, Thomas E. Eagan, chief metallurgist, Cooper-Bessemer Corp., Grove City, Pa., will discuss "Engineering Properties of Gray Iron for Foundrymen." Thursday's program also includes a banquet at which Ralph L. Lee, General Motors Corp., Detroit, and popular columnist in FOUNDRY will be the featured speaker.

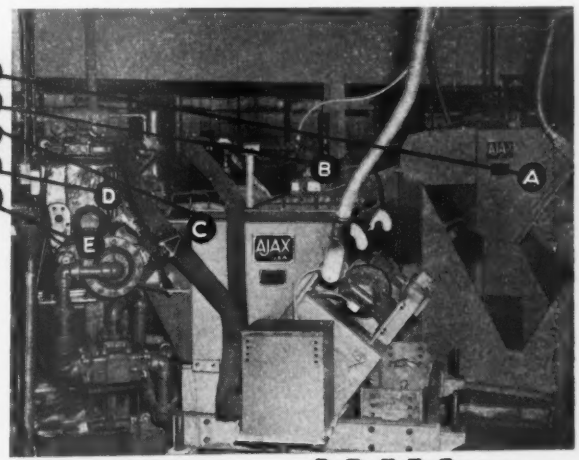
"Studies on Improvement of Machinability of High Phosphorus Gray Iron" will be presented by Dr. W. W. Austin, Southern Research Institute, Birmingham, at Friday's technical session at which the AFS movie "Fluid Flow in Transparent Molds," also will be shown. Friday evening will be devoted to entertainment in the form of a floor show, and there will be luncheon meetings Thursday and Friday.

Charles K. Donoho, chief metallurgist, American Cast Iron Pipe Co., vice chairman of the chapter is program chairman for the conference, which is under the direction of Chapter Chairman Morris L. Hawkins, Stockham Valves & Fittings.

A visitation program includes foundries and suppliers' plants in the Birmingham district. The committee hopes to add several more plants in addition to the following which were open last year: Alabama By-Products Corp., Alabama Clay Products, American Brake Shoe Co., American Cast Iron Pipe Co., Anderson Brass Works Inc., W. J. Bullock Co., Caldwell Foundry & Machine Co., Continental Gin Co., Foundry Service Co., Hill & Griffith Co., McWane Cast Iron Pipe Co., Harbison-Walker Refractories Co., Jefferson Foundry Co., Miller Foundry Co., National Cast Iron Pipe Co., Pressure Cast Products Corp., Southern Car & Mfg. Co., Sloss-Sheffield Steel & Iron Co., Stockham Valves & Fittings, Joe Stone Foundry Co., Southern Precision Pattern Works, Thomas Foundries Inc., and Unit Stove & Furnace Co.

Air Reduction Co., 60 East 42nd St., New York 17, has purchased a 23-acre site at Butler, Pa., for erection of a plant for the manufacture of oxygen and nitrogen and other gases extracted from the air.

Induction melting furnace
Electrically heated launder
Induction holding and pumping unit
Pump nozzle
Cold chamber of die casting machine



Streamlined Molten Metal Supply by AJAX

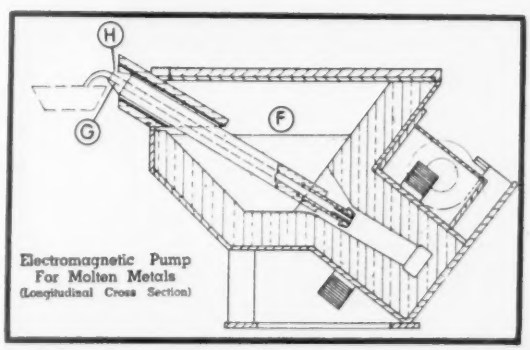
Photo courtesy Scintilla Magneto Div., Bendix Aviation Corp.

NO HAND LADLING

Once the metal is in this AJAX furnace, no further attention is necessary . . . no checking for temperature or timing. An electromagnetic pump (connected with an automatic timer and with the controls of the casting machine) discharges a predetermined weight of metal at precise and regular intervals. This method averages 25% greater output of acceptable castings over that of hand ladling.

In the induction pump (diagram at right) the metal level in the nozzle (G), while idling, is held at all times near the opening (H) and high above the level (F) in the furnace. Thus oxidation in the tube is prevented. When pumping, the molten metal travels only a very short distance, and each shot is completed swiftly.

CONTINOUS AUTOMATIC OPERATION OF DIE CASTING MACHINES



Electromagnetic Pump For Molten Metals (Longitudinal Cross Section)

Diagram above taken from "Liquid Metals Handbook" published by Atomic Energy Commission

AJAX TAMA-WYATT

AJAX ENGINEERING CORPORATION, Trenton 7, N. J.

INDUCTION MELTING FURNACE

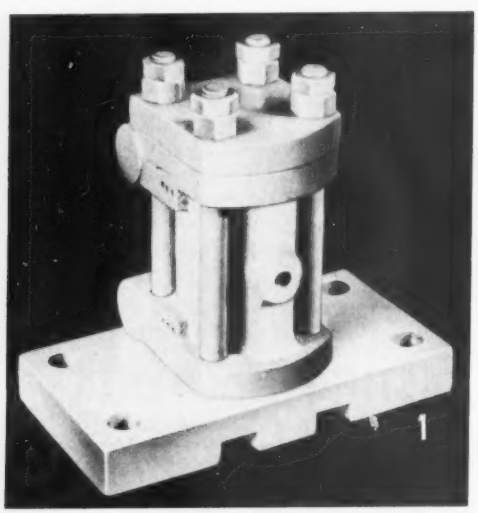
AJAX ELECTRO METALLURGICAL CORP., and Associated Companies
AJAX ELECTROTHERMIC CORP., Ajax Northrup High Frequency Induction Furnaces
AJAX ELECTRIC CO., INC., The Ajax Hultgren Electric Salt Bath Furnace
AJAX ELECTRIC FURNACE CORP., Ajax Wyatt Induction Furnaces for Melting

New EQUIPMENT *and Supplies*

For Additional Information on these Items Use Reply Card—Page 219

(1)—Vibrator: Cannon Vibrator Co., 1108 Power Ave., Cleveland 14—New, "quiet type" vibrator is designed for use on bins, hoppers, chutes, and shakeouts. There is no impact of the piston on either end, no metal to metal pounding, no springs, no ear-splitting noise, it is claimed. Vibrators are said to produce intense, positive vibration. They are furnished in 1⅝-in. to 4-in. sizes.
For More Details Circle No. 1—Page 219

(2)—Compressors: Chicago Pneumatic Tool Co., Six East 44th St., New York 17—Horizontal duplex air compressors have antifriction roller bearings throughout: Spherical main bearings support the crankshaft and also are used at the crank pin end of the connecting rod; double row needle bearings are used in the crankhead end of the connecting rod. This feature is possible through recent development of the oil injection method of bearing and crank disk installation and removal. Ordinary hand tools and a portable, hand-operated hydraulic pump are used for installation and removal work. The method is said to permit use of one-piece crank disks and connecting rods. The self-adjusting roller bearings are lubricated by the full-flood method, eliminating pumping mechanism.
For More Details Circle No. 2—Page 219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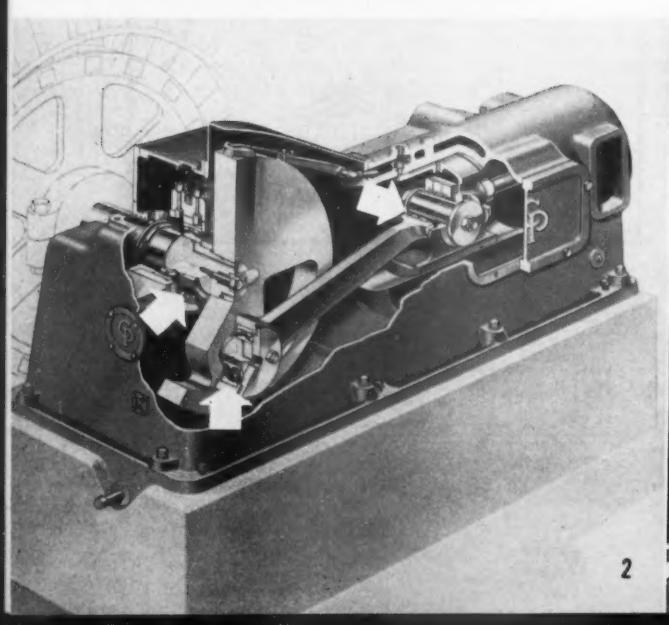
(3)—Tilting Dial: Hydroway Scales Inc., 20624 West Eight Mile Rd., Detroit 19—Tilting dial faces now are available as an optional feature on the company's line of hydraulic crane scales manufactured in capacities up to 100,000 lb. Downward tilt of the face by as much as 25 degrees is made possible by insertion of a "V" section between the dial and hydraulic chamber housing. Because of other necessary provisions the work must be done at the factory, and it is not practical to alter scales now in use.
For More Details Circle No. 3—Page 219

(4)—Ladle Gearing: Industrial Equipment Co., 115 North Ohio St., Minster, O.—Worm ladle gearing, completely enclosed and self-contained, is said to be unaffected by heat and to be self-locking in any position. Back-lash adjustments to pin-point accuracy and positive adjustment of bearing lock nuts on all gears and worm are made quickly. All gears are precision cut, and shafts are mounted on antifriction bearings. Company also offers a universal bail which is said to eliminate binding due to heat distortion or misalignment and gear wear due to binding. It is said to require no lubrication or adjustment.
For More Details Circle No. 4—Page 219

Electrode: Harnischfeger Corp., 4405 West National Ave., Milwaukee 14—New electrode, produced in ⅛, 5/32, and 3/16-in. sizes, is used with best results on a direct current welder, straight polarity. Satisfactory performance also is obtained on a heavy-duty alternating current ma-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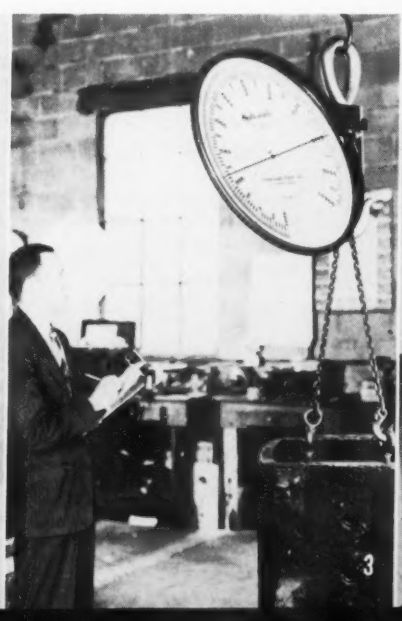
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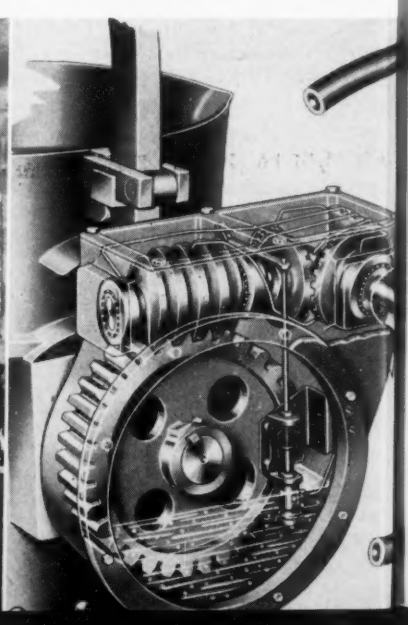


chine that has a minimum open circuit voltage of 80. Penetration into work piece averages ¼-in., and very little deposit of weld metal is made, the weld consisting mainly of parent metal, it is claimed. Tensile strength of the weld metal is about 75,000 psi, and elongation is 18 per cent. The electrode also may be used as a gouging tool and for cutting.

For More Details Circle No. 5—Page 219

Weight Recorder: Howe Scale Co., Strongs Ave., Rutland, Vt. —New device for recording scale weights is used with the company's tape-drive dial scales and cabinet (drop weight) dials. Weights may be printed on a wide variety of tickets and forms and single and double roll tapes. Printing device may be located 500 or more feet away from the scale, mounted on a desk or portable stand, built-in to control panels, or adapted elsewhere. It will print on a sheet up to 15 in. long, ⅜-in. thick and as wide as required. Ticket guides are available for single stop, two stop and multi-stop for successive lines up to 45. Correct positioning is accomplished by selecting the proper guide for the form being used. Printer can reproduce up to seven ticket copies at one time, using standard weight stock. Unit may be adapted to automatic weighing applications, it is claimed.

For More Details Circle No. 6—Page 219

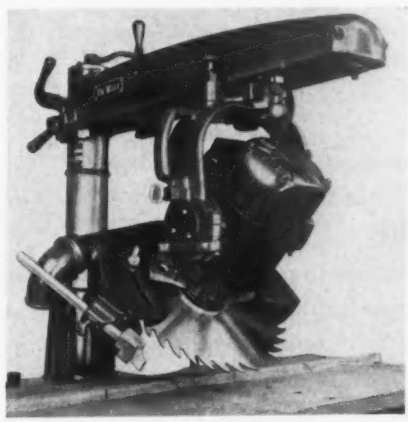
Goggle: American Optical Co., Southbridge, Mass.—One-piece, one-ounce, all-plastic safety goggle, designed to fit all faces, affords wide angle vision and can be worn over most standard types of personal glasses and most prescription spectacles and goggles. Features claimed are a comfortable plastic nosepiece, many perforations to minimize fogging and provide adequate ventilation, nonflammable plastic construction, and four-point contact with face by rolled edges for greater comfort. It is supplied in clear or green plastic styles and has an easily adjustable elastic headband to insure snug fit.

For More Details Circle No. 7—Page 219

Hand Truck: Standard Pressed Steel Co., Jenkintown, Pa.—Two-wheeled hand truck has the following features: Frame—steel channel, all welded, single handle; cross members —steel channel, curved; nose: heavy, pressed steel ribbed for strength, angle shape for stronger weld to frame; axle: alloy steel, ⅝-in. in diam; wheels: 6 in. in diam with ball bearings and rubber tires, or 5 in. in diam with plain metal bushings, resilient rubber tread and hard rubber cores.

For More Details Circle No. 8—Page 219

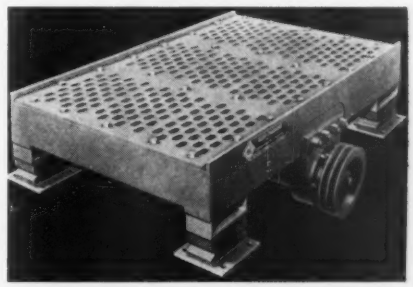
Radial Arm Saw: DeWalt Inc., 1400 Fountain Ave., Lancaster, Pa.—Radial arm saw is powered by a direct-drive motor so designed that there is a reduction of the distance



from the extreme bottom of the motor casing to the saw arbor. This reduction allows a cutting depth of 4½ in. with a standard 14-in. saw blade. Motor is totally enclosed and is equipped with sealed-for-life bearings. Saw is available with motors ranging from 2 hp ac/dc to 3 hp single phase and from 3 to 5 hp polyphase.

For More Details Circle No. 9—Page 219

Shakeout: Allis-Chalmers Mfg. Co., 1032 South 70th St., Milwaukee —Company's two - bearing shakeout line has been extended to include smaller general purpose units with capacities from 2000 to 5000 lb. New units have a simplified mechanism, removable from the shakeout body. Drive shafts extend on one side only, requiring just one dust seal. Sheaves are eccentrically bored to compensate for amplitude of vibration so that operating amplitudes are not transmitted to motors. Units have bottom plates of rubber mountings for bolting to the foundation, baffle plates for diverting sand toward the center of the collecting hopper, and transverse stiffeners in the body for adequate deck support. Shakeouts may be installed with deck horizontal or sloped for discharging duty. Portable bases are available so that the shakeout, complete with motor, drive and starter, can be moved around the foundry. Units are available with optional high side skirt boards, skid bar type decks and various punched perforations on the deck plate up to 2 x 4 in.



For More Details Circle No. 10—Page 219

Air Gun: Chas. W. Riebel Co., 209 West Main St., Louisville 2— Brass air gun—again being offered by this company—has a valve located in the direction of the longitudinal axis of the gun and which closes concentrically. Air passage through the gun is equal everywhere, avoiding uneven wear of the surfaces. Valve and pivot are completely enclosed, protected against injury. Valve lining is a rubber composition disk, sunk and secured in the valve cup. Valve is controlled by an angle lever which regulates accurately air flow as desired. The air gun is said not to leak.

For More Details Circle No. 11—Page 219

Combustion Tubes: Burrell Corp., 1942 Fifth Ave., Pittsburgh— Mullite and zircon high-temperature combustion tubes for high temperature furnaces are said to perform satisfactorily up to 2900°F. Tubes are said to be gas tight, straight and accurately sized, and to remain free from devitrification. Both tubes are offered in a variety of lengths and diameters, and come with straight, uniform diameters or tapered ends.

For More Details Circle No. 12—Page 219

Fire Extinguisher: American-LaFrance-Foamite Corp., 10 East LaFrance St., Elmira, N. Y. — Wheeled, portable engine fire extinguisher for flammable liquid and elec-

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trical industrial fires is packed with 350 lb of dry chemical compound discharged by dry nitrogen at a maintained operating pressure of 200 psi. Density of the dispersion of the extinguishing compound cools and insulates the operator from heat of the fire. Extinguisher has a discharge range of 20 to 25 ft.

For More Details Circle No. 13—Page 219

Protective Hood: Chicago Eye Shield Co., 2300 Warren Blvd., Chicago 12—Air-fed hood for use in toxic dust and fumes is made of light-weight, flexible, rubberized fabric. Clear plastic window allows wide angle vision, and its adjustable, plastic headband is mounted to the hood on a friction swivel permitting

full vision up or down as the user moves his head. Air fed into the hood is tubed to each side of the face, then diffused and filtered through cloth bags so that a constant supply of fresh air is maintained directly in the respiratory zone. Further protection is given by a soft cotton bib which acts as a baffle to keep out dust. It zips out for cleaning. It is claimed that the hood fabric protects head, shoulders, chest, and back of wearer against flying particles. It also is waterproof and acid-resistant.

For More Details Circle No. 14—Page 219

Jointer: Heston & Anderson, Fairfield, Iowa—Six-inch jointer has tables 60 in. in overall length. Setting of each table is controlled by handwheels at the front of the machine. Jointer uses a three-knife head, 2⅞ in. in diam, operating at 6000 rpm on heavy-duty, dustproof, life-sealed bearings. The fence or guide is 37 x 4 in. It tilts 45 degrees and may be set at a 7-degree

(*Continued on page 222*)

HELPFUL LITERATURE

50. Welding Electrodes

Harnischfeger Corp.—56-page illustrated vest-pocket electrode guide R7-8 charts properties, applications and available sizes of all classes of electrodes for welding, hardfacing and surfacing.

51. Diecasting Machines

Reed-Prentice Corp.—Brochure of five illustrated bulletins covers two sizes of diecasting machines for lead, tin or zinc base alloys; one model for aluminum, magnesium or brass alloys; and two combination units for both functions.

52. Hand Pallet Truck

LYON-Raymond Corp.—2-page illustrated bulletin 222 describes heavy duty hand-operated hydraulically-elevated pallet lift truck which is available in 4000 and 6000-lb capacities. Models can be supplied in 25 to 30-in. widths and in lengths of 30 to 60 in.

53. Blast Cleaning

American Wheelabrator & Equipment Corp. — 8-page illustrated pocket-size bulletin No. 454 explains advantages of using continuous airless abrasive blast cleaning equipment and cites actual production figures for five sizes of Continuous Tumblasts.

54. Silicon Briquets

Electro Refractories & Alloys Corp. —4-page illustrated bulletin D-850 on Electro-Carb briquets explains results obtainable with this silicon carbide deoxidizer in producing various types of iron castings.

55. Grinding Wheel Bond

Chicago Wheel & Mfg. Co.—4-page illustrated folder "79E" describes new vitrified bond developed for use in company's grinding and mounted wheels. This abrasive development is reported to afford 5 to 10 per cent increase in grinding and finishing output.

56. Abrasive Segments & Wheels

Bay State Abrasive Products Co.—4-page illustrated bulletin and magazine reprint feature abrasive segments to fit any chuck assembly and various types of abrasive wheels designed for all types of surface finishing equipment.

57. Instrument Sensing Units

Wheelco Instruments Co.—42-page illustrated bulletin TC-8 contains prices, application recommendations and pertinent information concerning instrument sensing units and associated accessories. Included in listings are resistance bulbs and wells, radiation detector, special thermocouples and molten metal thermocouple for ferrous metals.

58. Mobile Crane Loader

Mandt Mfg. Co.—12-page illustrated broadside "Model 78" is descriptive of combination swing loader, mobile crane and backhoe. Pneumatic-tire-mounted unit has full hydraulic operation, 8000-lb drawbar pull on crowding, 180-degree swing, high dumping clearance and ⅞-yd bucket which can be swung to clear 10-ft. swath.

59. Overhead Crane

Whiting Corp.—20-page illustrated catalog M-20 describes Trambeam light crane and monorail-system designed for low-cost handling of loads from 250 to 20,000 lb.

60. Portable Power Tools

Skilsaw, Inc.—72-page illustrated catalog "Skil Portable Tools" depicts and describes over 135 portable electric and pneumatic tools for manufacturing, construction and automotive service industries.

61. Materials Loaders

Lull Mfg. Co.—Illustrated bulletins AD12, 32 and 33 are descriptive of tilting tower and standard model universal loaders, Shoveloaders for foundry and industrial usage and various Shoveloader attachments, respectively.

62. Wage & Cost Controls

Lester B. Knight & Associates, Inc. —8-page brochure outlines effective system to control foundry wage payments and costs. Five parts of system include incentives, labor control, formulas, production control and simplified standard cost system.

ADDITIONAL INFORMATION?

For additional information on any of the items described under "New Equipment and Supplies", "Trade Publications" or "Helpful Literature" in this issue — simply circle their corresponding item numbers on one of these cards.

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63. Metal Inspection

Dy-Chek Co. — 2-page illustrated bulletin 503 on dye penetrant method of metal inspection is one of series of "Inspection Clinic" monthly letters which provides interchange of technical information and 'shop talk' on subject. This letter covers finding defects in weldments, stainless steel, deep drawn and spun parts, extrusions and railroad diesel engine blocks.

64. Foundry Accounting

McBee Co.—4-page illustrated form No. S-420 is reprint of technical article entitled "Production Line Technique Applied to Foundry Labor Accounting" in which Ferro Machine & Foundry Inc. of Cleveland serves as case study. Time or job cards used differ from conventional type in that they have punched holes around margins which correspond to information on face and permit quick and accurate sorting.

65. Duplex Compressors

Chicago Pneumatic Tool Co.—24-page illustrated bulletin No. 726-5 describes Class O-CE horizontal duplex motor-driven compressors that feature anti-friction roller bearings throughout design. Standard models range from 350 to 10,000-cfm capacities for 80 to 125-psi service.

66. Dry Chemical Extinguisher

American-LaFrance-Foamite Corp. —4-page illustrated form AD 12020 portrays model 350 wheeled portable dry chemical engine which can be pulled easily by two men. It is approved by Underwriters' and Factory Mutual Laboratories for Class B and C fires.

67. Vibrating Screens

Link-Belt Co.—12-page illustrated book No. 2354 portrays type CA concentric action vibrating screens for medium and heavy duty service. Units can be used for sizing, rinsing and dewatering wide range of materials. They are made in sizes from 3 to 6 ft wide and 8 to 16 ft long.

68. Tractor-Shovel

Tractomotive Corp.—16-page illustrated form No. 892-10-50 covers design features, specifications and applications of HD-5G Tracto-Shovel which consists of Allis-Chalmers HD-5G tractor equipped with Tractomotive TS-5 hydraulically operated shovel.

69. Portable Mold Dryers

Foundry Equipment Co.—4-page illustrated bulletin No. 802 presents information on recirculating air portable mold dryers of gas or oil fired type that provide fast uniform drying of pit molds or flask work too large for handling in mold ovens.

70. Foundry Techniques

Foundry Services Inc.—12-page illustrated regular publication "Foundry Practice," No. 100, contains information on fastening cores by nailing, treatment of Alcoa alloy No. 142 and various alloy structures.

71. Quick-Acting Vise

Dodge Mfg. Corp.—4-page illustrated bulletin A-601 shows how new Slide-Set vise speeds all types of bench and assembly operations. Fast slide action of this heavy-duty 4-in. vise affords quick grip of part. Turning no-pinch handle clockwise holds work securely. Ratchet-pawl action minimizes operator fatigue.

72. Pneumatic Vibrators

SPO Inc.—8-page illustrated catalog 50 describes line of pneumatic vibrators and accessory items. Eight standard types of vibrators are covered and their over-all dimensions, weights, piston diameters and air consumption listed in chart form. Units can be used on bins, hoppers and chutes handling powdered or granular materials.

73. Fork Truck Accessories

Towmotor Corp.—2-page illustrated leaflets AD-6 and AD-4 describe ram device for handling all types of 'open-center' loads and fork extensions for handling loads longer than those ordinarily carried on standard lift truck forks. Ram accessory is controlled by standard lifting and tilting mechanisms of truck, while extensions fit over standard forks.

74. Foundry Chaplets

Fanner Mfg. Co.—32-page illustrated catalog No. 1050 lists many different types of chaplets including Groovestem model designed to insure maximum fusion and core support. Also covered are motor, radiator, small and medium double head, solid button or boiler, wrought iron forged single head and double angle styles.

75. Fork Lift Truck

Mercury Mfg. Co.—4-page illustrated bulletin No. 295 describes model No. 230 2000-lb Jeep fork truck which has 130-in. extreme lift, 59½-in. free lift and 83-in. collapsed height. Features include inclined automotive steering, foot pedal acceleration and low pressure hydraulic lift with cross suspension.

76. Speed Reducer

Falk Corp.—16-page illustrated bulletin 3110 presents data on all-steel right-angle Motoreducer which can be used for either horizontal or vertical applications and is available with output shaft single or double ended. It is furnished with integral motor or in All-Motor design which is adaptable to any foot-mounted motor. Horsepowers range from 1 to 50 and ratios are from 1:1 to 972:1.

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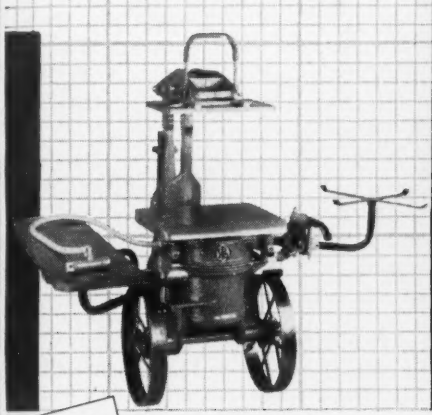

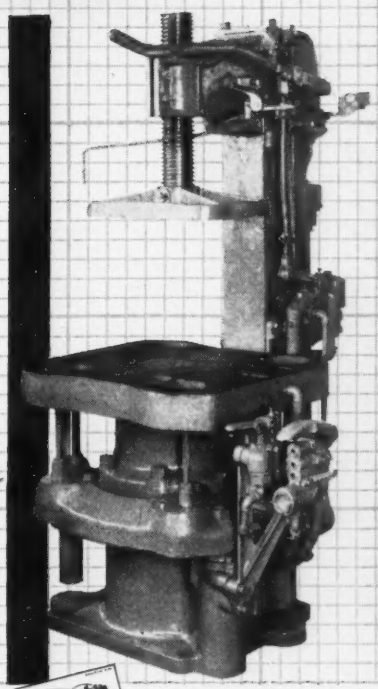

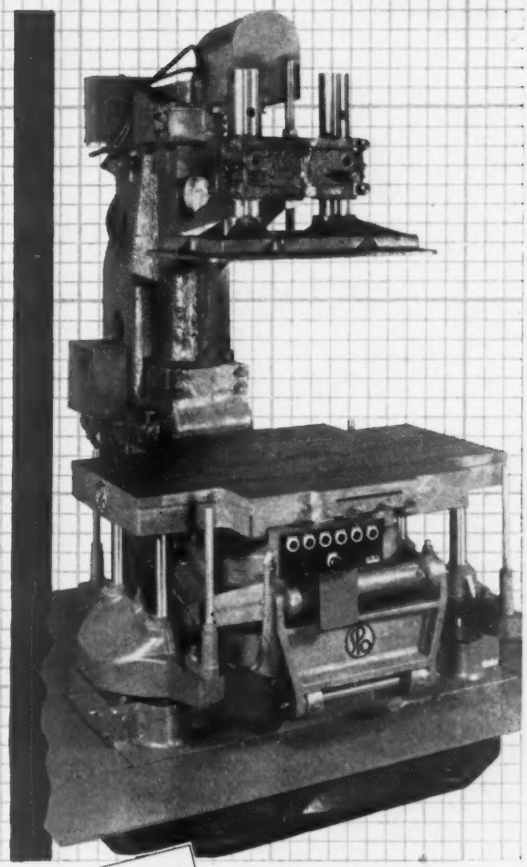

Jolt-squeeze machines (eight models) are described and illustrated in SPO Series No. 100 catalog. Post machines with swing heads and cantilever type squeezers are shown with complete specifications.

Eight models of MILWAUKEE Jolt-Squeeze-Pin Strippers are described in detail in Bulletin No. 110-A. Construction features, operating data, and production capacities are charted for reference.

Push-button operated jolt-squeeze-strip machines are described in SPO Series No. 200 catalog. Design features, automatic push-button type control, and production capacities are covered in detail.

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Designed by experienced foundrymen, these SPO machines are available in a wide range of sizes and models to meet all foundry molding requirements. Simplified control, safe operation, and precision accuracy are built-in features which assure the production of copes and drags of uniform standard.

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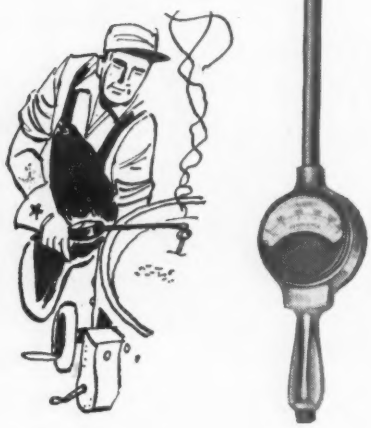


For quick, accurate temperature readings of molten metals, operators of non-ferrous foundries everywhere are relying on the Alnor Pyro Lance. Portable, handy to use, the Pyro Lance has a protected thermocouple, with adjustable angle head, mounted in the lance tip. It takes temperature below the surface —unaffected by dross or other conditions. Here's an easily handled instrument to help control quality in the foundry. For complete information and prices on this valuable instrument write for Bulletin No. 1724-D. Illinois Testing Laboratories, Inc., Room 511, 420 N. LaSalle St., Chicago 10, Illinois.

Alnor

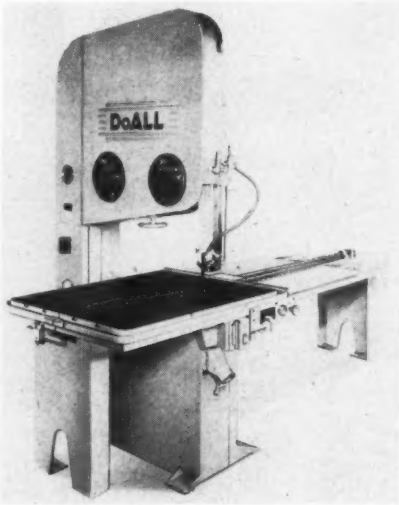
PRECISION INSTRUMENTS FOR EVERY INDUSTRY

(*Continued from page* 218)

angle across the cutter head. This setting provides a shearing cut and is desirable when jointing grainy or knotty stock. Rabbeting capacity is ⅝-in. with a rabbeting arm support 8½-in. long, extending 3 in. from the bed.

For More Details Circle No. 15—Page 219

Band Saw: DoAll Co., 254 North Laurel Ave., Des Plaines, Ill.—Ferrous and nonferrous metal cutting band saw has hydraulic feed, throat capacity of 36 in. and work height from 15½-in. up. Machine uses a 10-hp drive motor and has a three-speed transmission and overload protected variable drive that gives a tool speed range of 40 to 10,000 fpm. The 40 x 48-in. T slotted hydraulic table is said to be capable



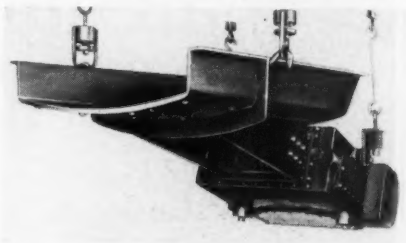
of supporting work pieces weighing a ton or more. Table sides on 28 rollers distributed over a 36 x 87 in. bed. Correct feed pressure is controlled automatically by the resistance of the work as the saw encounters changing material thickness. The infeed rate is controllable up to 18 fpm with quick return. Other features include job selector dials and complete sets of guides for slow and high speed sawing, band speed and tension indicating dials, converging beam work light, chip blower and dust spout for exhaust connection. Machine is well guarded and has automatic synchronized hydraulic aircraft type brakes.

For More Details Circle No. 16—Page 219

Grease: E. F. Houghton & Co., 303 West Lehigh Ave., Philadelphia 33—Oxidation inhibited multipurpose grease is said to resist high heat, cold or wet conditions. It is a cold-milled grease of smooth texture, with good oxidation stability. It reportedly clings well to all metal surfaces, minimizing leakage. The grease is available in two consistencies, NLGI No. 1 and No. 2.

For More Details Circle No. 17—Page 219

Feeders: Syntron Co., 540 Lexington Ave., Homer City, Pa.—Company's line of vibratory feeders has been supplemented by a dust-



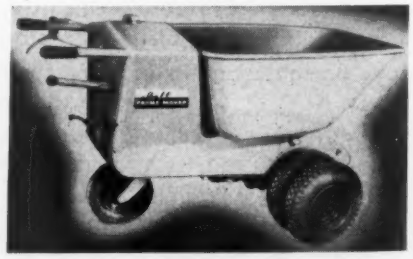
tight model on which the working parts—the leafsprings, the armature, and the core—are covered by gasket-sealed plates bolted to the magnet casting. By enclosing these parts, protection is obtained against clogging by excessive supply hopper spillage or heavy dust conditions. Addition of this sealed protection does not affect the feed rate, which ranges up to hundreds of tons per hour of bulk, dry or damp, hot or cold, fine or coarse materials, it is claimed.

For More Details Circle No. 18—Page 219

Riser Sleeves: Schecter Brothers Co., Hancock & Huntingdon Sts., Philadelphia 33—Riser sleeves for use on molds for nonferrous castings are made from a low heat conductivity material known as Literock. Use of the material also is said to reduce the amount of riser metal needed and permit a smaller riser stem, resulting in less cut-off time. Sleeves can be furnished to specification, or the material can be furnished in block form, square or round, for tooling and shaping.

For More Details Circle No. 19—Page 219

Power Wheelbarrow: Prime Mover Co., Muscatine, Iowa—Power wheelbarrow has been redesigned and



improved with these new features: Forward direct drive with half speed reverse under power, 5-hp Wisconsin engine, constant mesh transmission, and conveniently placed operator's controls. Engine and gasoline tank

are located in enclosed panel on top and at rear of chassis, away from floor dirt. Two sizes of platforms with stakes are interchangeable with the bucket. Capacity has been increased to 1500 lb, bucket or platform load. Unit is 31½-in. wide and has a turning radius of 33 in.

For More Details Circle No. 20—Page 219

Goggle: United States Safety Service Co., 1215 McGee St., Kansas City 6, Mo.—All-plastic safety goggle has a one-piece removable and interchangeable plastic lens. Lens is made from an optical safety plastic which meets government specifications for optical qualities and impact resistance. Lens are available in clear or antiglare green. Goggle frame, of

soft vinyl, is firm, yet pliable enough to effect a tight seal against the face and protect against acid splashes, dust, flying objects, etc. Four types of ventilation are available to meet specific needs. Goggle fits over personal glasses.

For More Details Circle No. 21—Page 219

Vitrified Bond: Chicago Wheel & Mfg. Co., 1101 West Monroe St., Chicago 7—Use of a new vitrified bond in grinding wheels is said to assure a smooth, fast cutting action at speeds up to 6000 sfpm. Other claims are: Less wheel breakdown and lowered downtime for changeover or wheel dressing. Among recommended uses of the new bond are portable grinding of billets, brake drums, forgings and forging dies, annealed malleable castings, steel castings, and stainless steel welds.

For More Details Circle No. 22—Page 219

Parting Compound: Borden Co., Chemical Division, 350 Madison Ave., New York 17—Parting compound for use with plastic core binding resins is added at the muller as the final addition to the core mix

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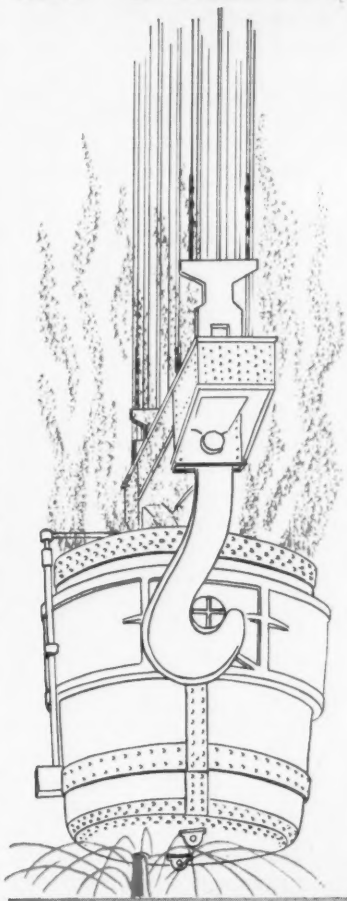

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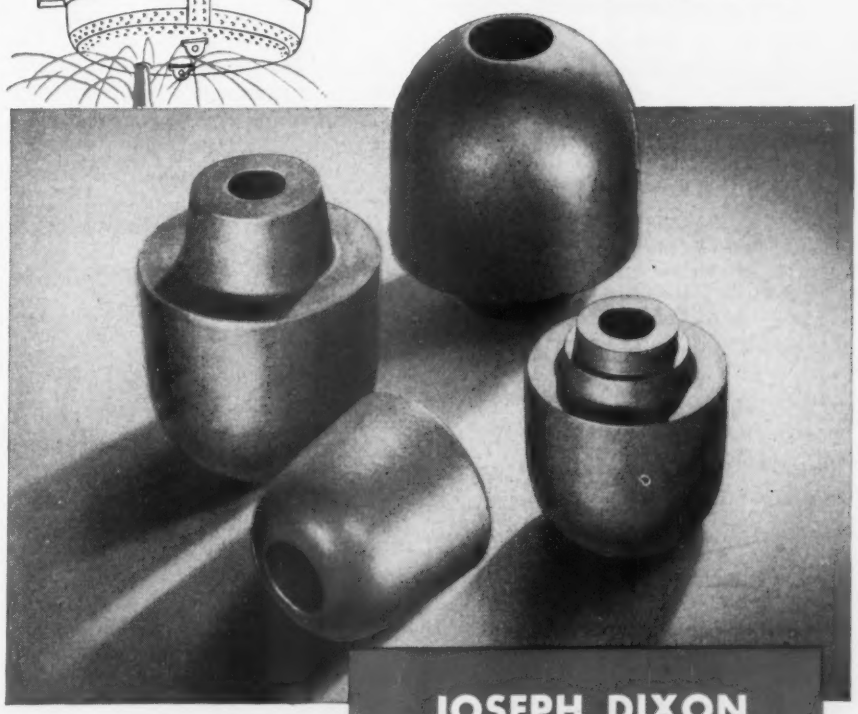
- Greater Resistance to Erosion
- Greater Uniformity in Manufacture
- Greater Dependability in Service



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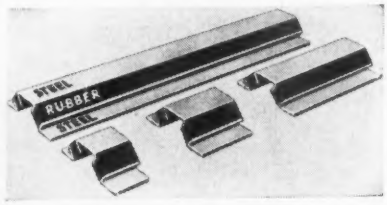
and has been developed to produce better working foundry sand mixes having good release characteristics. Compound is said to produce a mix that flows into and releases easily from coremaking equipment, eliminating production losses due to sticky core sands.

For More Details Circle No. 23—Page 219

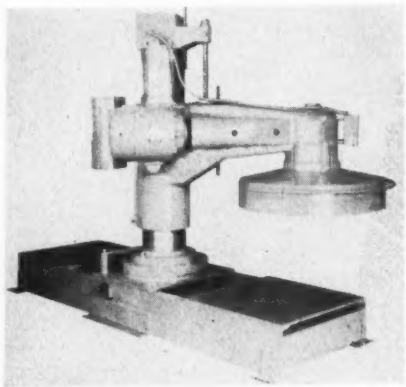
Vibration Isolator: Finn & Co., 2850 Eighth Ave., New York 30—Vibration isolator adaptable to many types of machinery and equipment



consists of a specially designed steel channel floated in rubber between two steel angles. The correct angularity between the steel parts and the rubber securely bonded thereto enables the isolator to approximate the "flat" spot on a stress-strain curve of relative slope. Because the spring index (load divided by deflection) is not constant, resonance is said to be avoided. Isolator is available in any length up to 18 in. in four rubber stiffnesses for loads of 40, 50, 70, and 105 lb per inch of length at ¼-in. deflection.

For More Details Circle No. 24—Page 219

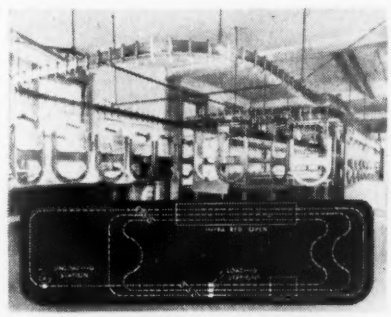
Core Grinder: Milwaukee Foundry Equipment Division, SPO Inc., 6448 Grand Division Ave., Cleveland 25—Dual type core grinder makes possible grinding of large cores at one grinding station while the second station is being unloaded



and reloaded. Employing a 42-in. grinding wheel with a 38-in. effective cutting diameter, grinder can handle a wide range of intricate or cumbersome cores. Adjustable wheel arm, balanced to provide smooth performance, swings progressively around a complete 360-degree arc to accommodate existing core handling systems at either one of the two grinding stations. Wheel height above the table ranges from 15 in. minimum to 42 in. maximum. Powered by a 5-hp, 900-rpm motor, the grinding wheel operates at 242 rpm.

For More Details Circle No. 25—Page 219

Conveyor: Lightweight Conveyor Co., 18690 Lauder Ave., Detroit 35—Conveyor for carrying relatively light parts can be operated as a bench, overhead, or portable conveyor system. The system shown utilizes a continuous belt 256 ft long, and is powered by a 1/3-hp motor. Conveyor weighs 3 lb per foot, and installation requires no superstructure it is claimed. Conveyor is offered in 2, 4, 6, 8, and 10-ft sections with "els," "45's," etc., similar to standard pipe. Capacity is approximately three hangers per foot with a 25-lb load per foot. Forms permit a



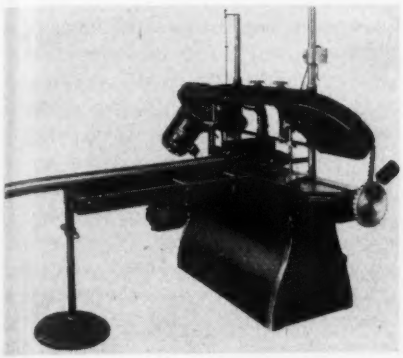
horizontal bend from a straight or weaving line to a 180-degree turn in a radius of 3½-in. or less. Parallel lines can run as close as 1⅜-in. apart. A vertical bend 90 degrees straight up or down in a 36-in. radius also is practical, it is said.

For More Details Circle No. 26—Page 219

Separator: Dings Magnetic Separator Co., 4740 West Electric Ave., Milwaukee 46 — Permanent, double drum, magnetic separator, for automatic segregation of magnetic from nonmagnetic materials, incorporates two magnetic drums, one mounted directly above the other, enclosed in a dust-tight housing. Each drum consists of a stationary nonelectric magnet assembly around which revolves a nonribbed armor plate drum shell. Magnetics are held fast to the surface of the shell for one half revolution until they are carried to a point beyond the magnetic field, to be separately discharged. As the material is spouted from the first to the second drum, it is turned over so that a more effective secondary separation takes place. Complete unit is available in nine different sizes.

For More Details Circle No. 27—Page 219

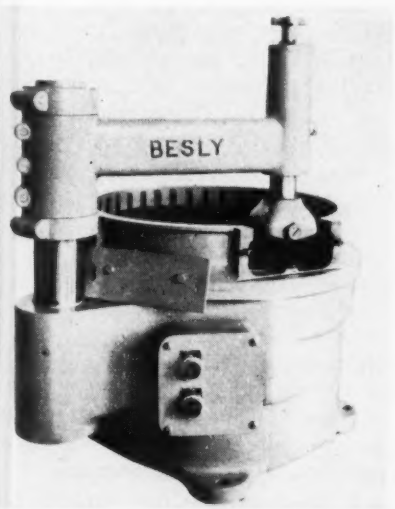
Metal Saw: W. F. Wells & Sons, Three Rivers, Mich.—Metal cutting band saw has a capacity of 14 x 18 in., maximum clearance under saw blade of 20 in., a quick-action vise which swivels 45 degrees in either direction and clamps rigidly in



all positions, and cutting speeds of 60, 90, and 120 fpm. Among its features are a rotating blade brush which cleans chips from between the teeth as well as from the sides of the blade; an adjustable and removable stock stop which automatically moves out and up at completion of each cut to eliminate binding of stock on blade; and hydraulic controls for providing automatic cutting, stock feed, and vise tightening.

For More Details Circle No. 28—Page 219

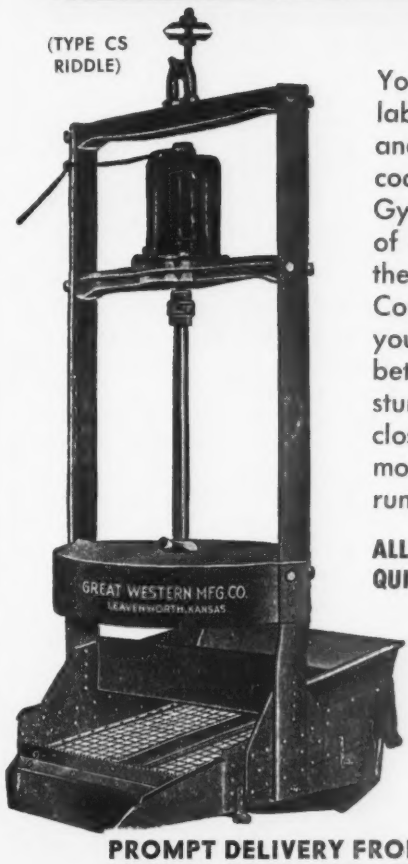
Grinder: Charles H. Besly & Co., 621 Third St., Beloit, Wis.—Small, bench model vertical spindle grinder for light work weighs about 575 lb with its 18-in. diam abrasive wheel. Unit is 31 in. high and 28½-in. wide overall. Grinder uses a pancake type three-phase, 60-cycle motor. It is



totally enclosed and fan cooled and is rated at 5 hp at 1160 rpm. Crossarm, pedestal, motor driven coolant pump, tank, and piping for wet grinding are optional equipment.

For More Details Circle No. 29—Page 219

(TYPE CS RIDDLE)



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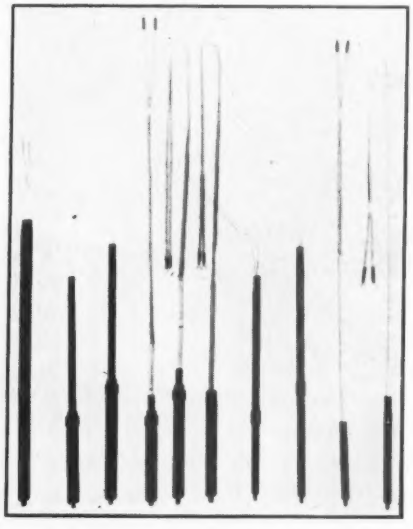

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Metallic and Nonmetallic Coatings for Gray Iron

(*Continued from page* 111)

prove surface appearance. The improvement in appearance results from the fact that the coats themselves, including as they do combinations of various colored or metallic enamels, possess three-dimensional characteristics. These so-called wrinkle, hammered, or spatter finishes blend well with and de-emphasize any small irregularities normally exhibited by an as-cast surface[71, 74].

Wrinkle finishes[75], usually sprayed directly on castings, owe their character to the contraction of the upper layers of the sprayed paint into ridges during drying. This produces an economical, attractive and durable finish. The wrinkle finishes, normally one-coat applications, can be varied in texture from very fine (suede) to very coarse (pine tree) patterns. They are most successful in color ranges below the lightest colors. It is normally necessary to bake the finish, air drying wrinkles having been generally unsuccessful to date.

The so-called hammered finishes exhibit the appearance of round indentations such as are seen in hammered aluminum, copper, etc. The effect depends on metallic powders, usually of aluminum, suspended in the paint. The "pattern illusion" is very attractive and greatly enhances the appearance. The hammered finishes in common with the wrinkle finishes can be applied in one spraying, have good adhesion and film qualities, but possess much less depth of texture than wrinkle finishes. They can be either air dried or baked.

The spatter finishes[72] consist of a base coat over which a layer of heavily textured spatter has been applied. These two coats may be of the same or of contrasting colors. This finish has the advantage of being thicker, tougher and, therefore, more protective than either the one-coat wrinkle or hammered finish. For best results and film quality, it should be baked, but air drying spatters have been developed.

Shop Coats and Primers—The importance from a marketing point of view of protecting castings against corrosion in storage and shipment is not always sufficiently recognized. The thin film of rust which can form on storage or shipment, although it normally does not in itself lessen the usefulness of a casting, may lower considerably its sales appeal and may complicate subsequent finishing treatments.

The simplest method of corrosion protection for short periods is the application of a corrosion-inhibitive oil or grease. However, for extended yard storage a more durable and permanent coat is needed, and various inexpensive paints have been developed to meet this need[70, 73, 76]. For example, "plow-share" lacquers will prevent rusting during shipment and storage, although they strip off as soon as the casting is put in use. Oleoresinous finishes are, however, more frequently employed. For example, under moderate corrosive conditions the widely used red oxide primers will provide good protection at comparatively low cost, but the pigment does not in itself inhibit corrosion. If the casting is to be submitted to more drastic corrosive conditions or exposed for longer periods, the more expensive and more protective red lead and zinc chromate primers are preferred. This increased cost can, however, be partly charged against subsequent finishing operations. Two or three of the above pigments may be mixed together in the same primer.

Although any of the above primers can be used as a base for further finishing of a casting, when a complete system has been decided on, the best procedure is to select a primer which will fit into that particular system. Thus if a synthetic resin air-drying system is to be used by the manufacturer of the finished product, a good modified alkyd-resin base primer will give excellent protection during shipment and, in addition, provide the best base for subsequent layers of paint. The higher cost of such a primer is often offset by the elimination of a rust removing or alternately a degreasing or stripping operation.

Complete Finishing System—For a still more protective and decorative coating than those previously described, a standard finishing system has been developed for gray iron machine parts. This system[77], applicable to any casting, may employ oleoresinous, lacquer or synthetic resin base finishes or combinations of these finishes, depending on the requirements of cost, speed, toughness and corrosion protection.

1. The casting is first sand or grit-blasted and deburred. Removal of any major irregularities at this point by grinding or other means will facilitate later filling operations.

2. If oil or grease is present, standard alkaline cleaners may be

employed. Removal of oil is particularly desirable if lacquer finishes are to be applied. One of the most useful cleaning preparations contains both solvents and phosphoric acid. It may be wiped on a large casting and will remove or convert to phosphates any rust that may be present, as well as produce a surface excellently adapted to organic finishes[72, 78, 79].

3. Immediately after cleaning a primer should be applied. As already described, this may contain corrosion inhibiting pigments such as red lead or zinc chromate, especially if the casting is to be stored previous to shipment or further finishing. If such a coat is applied at the foundry, it will prevent rusting during shipment. The primer also provides adhesion for further layers of paint, although this function is not as essential as in the case of other metals since gray iron naturally has a surface well adapted for paint adhesion. Interior machine or engine parts that will not be further finished, such as gearcases, should be coated with a special primer known as a "crankcase sealer" which prevents adhering sand or other abrasive material from getting into the oil and provides protection against corrosive action of the lubricants.

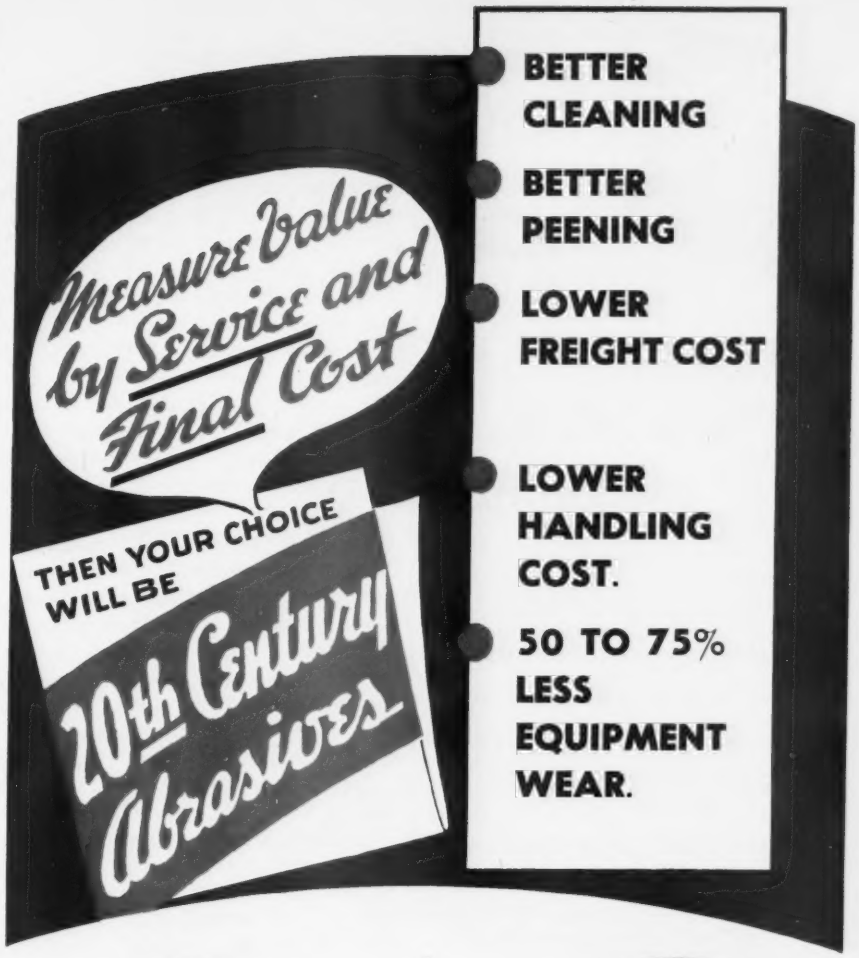
4. The filler or glazing putty is next knifed or squeezed onto the surface to smooth out any surface roughness. (On small castings this filler may merely be applied by spraying.)

5. The filler is then sealed with a coat of "sealer" or surfacer to provide a surface of maximum smoothness and minimum paint absorption for the finishing coats. This coat is simply a synthetic lacquer with a very low pigment-binder ratio.

6. After machining and assembly, another coat of sealer is sometimes used to repair any marring of the surface, and any desired type of final surface coat is then applied by dipping, spraying or brushing.

Special Synthetic Resins — In recent years many synthetic base paints have been developed for specific applications[79, 80]. It will only be possible here to list them and indicate their outstanding properties.

The oldest of these are the phenolic resins[81,82], characterized by their corrosion resistance, abrasion resistance, electrical insulating properties, and resistance to moisture and weathering. These desirable qualities have led to their application in the foodstuff industry, beer and wine industry, in chemical laboratories, and in high-temperature electrical



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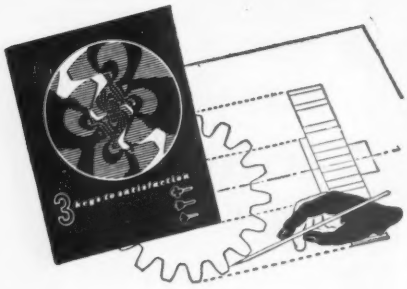

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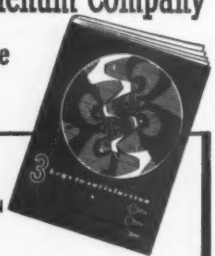

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Two other types of synthetics, namely vinyl resins[84] and chlorinated rubber[85] base paints, have recently assumed great importance to industry. The vinyls, besides being resistant to abrasion, caustic, moisture and corrosive conditions, are completely lacking in taste, odor or toxicity. They are thus particularly adapted to use in the food industry and in chemical manufacture. Chlorinated rubber base paints, because of their superior chemical resistance, in addition to hardness and rapid drying, are also finding widespread application in washing machines, commercial laundry and bottling machines, acid plants and oil refineries. These synthetics may be either air dried or baked.

Asphalt or Pitch-Base Enamels, Japans — Asphalt or pitch-base enamels have found application in cases where it is desired to increase the resistance of a casting to alkalies, sewer effluents, acids and continued exposure to tap waters. They are applied either hot or cold.

In the hot process, a bath of asphalt or pitch, which would be solid at room temperature, is liquefied by heating, usually with superheated steam. Castings, largely pipe or pipe fittings, are immersed in the liquid bath. The castings themselves are usually at an elevated temperature designed to limit running and still not produce an underbaked condition of the coating, which solidifies as the casting cools. Both materials can be and have been applied in the field. Some disagreement exists, however, as to the relative merits of asphalt as opposed to pitch. Asphalt is apparently superior to pitch in so far as it does not impart color, taste or odor to the water. On the other hand, pitch is used by many pipe foundries and is considered by some to furnish a little better corrosion protection. According to ASTM specifications the coal tar pitch should be blended with sufficient oil to give a tough, adherent coat. The temperature of the bath and the casting should approximate 300° F.[86]

The subject of relative protection furnished by pitch as compared to asphalt is debatable since there is an increasing tendency among pipe producers to consider such dipped enamels as only temporary underground protection[87]. If more permanent protecting is required, the pipe is usually asbestos wrapped using pitch or asphalt as a binder, or the pipe is cement lined.

Coating Applied Cold

In cold applications, the enamels are largely limited to the asphaltum type because of its superior solubility in the petroleum spirits (naphtha, toluol, benzol, etc.) used as thinners. The quick drying character of these enamels (10 minutes at 70° F) and the fact that the only preparation necessary is to free the casting from dust or granular material previous to coating, has served to popularize them. They are currently specified, for example, by the American Water Works Association as an inside and outside coating for gray iron valves, and at least one large pipe company is using the cold process of coating rather than the conventional hot process. The enamels for cold application can be sprayed, dipped or brushed on the castings.

Japan finishes have been included in this section because they incorporate materials such as gilsonite, asphalt or manjak pitches as one of the main constituents. However, the use of japan on a variety of castings in many ways resembles that of conventional paints or finishes. Japans vary from the low cost type containing simply gilsonite or asphalt dissolved in petroleum thinners, to more expensive varieties compounded to resemble lacquers with vegetable oils, plasticizers, etc. Because of very slow drying qualities, they are almost always baked at elevated temperatures (usually over 400° F for periods approximating 4 hours). They are naturally brownish-black to black in color (so-called "black japans") and lampblack is sometimes added to increase opacity[70]. If the correct quality is selected, a hard glossy, durable and abrasion-resistant film with good resistance to moderate heat and acids can be developed[88]. This, coupled with economy, has led to their use on heaters and similar equipment. The cheaper grades of japan may exhibit film brittleness and lower cor-

rosion resistance than higher cost paints.

Aluminum Paint—The presence of aluminum in an oleoresinous base paint yields a finish resembling a layer of solid aluminum. This is due to the fact that aluminum metal pigment can be produced in plate form. This metallic pigment "leafs"; that is, the flakes migrate to the surface of the paint film during drying. The resultant finish is resistant to corrosive atmospheres and to heat[80], and is particularly useful in providing maximum visibility of interior machine parts. For maximum heat resistance, an aluminum paint having a silicone resin vehicle is recommended.

Temporary Protection — Occasions arise where corrosion protection for only short periods during storage or shipment of castings, or simply light indoor protection, is required. By far the simplest method in such a case is to apply a thin film of a corrosion inhibitive oil or grease[72, 89] (0.0008-.002-in. thick) to the casting by either dipping or spraying. This is usually sufficient for short shipments or indoor storage up to six months. For outdoor storage (six to nine months), longer indoor storage (one to three years) or longer shipments, especially where the casting is likely to be exposed to weathering, a thicker film (0.002-.0035-in.) can be applied. These rust inhibitors, although they can be removed with petroleum solvents, alkali washes, or vapor degreasers, are usually recommended for castings to be used after shipment or storage in the as-cast or machined condition and which are not to be given further finishes. The above oiling or greasing methods have been found effective in preventing the thin film of rust that typically forms on all ferrous materials. Although not injurious to the efficiency of the cast part, such a film is considered unattractive by some consumers.

Vitreous or Porcelain Enamels — Vitreous or porcelain enamels have been used as surface finishes for gray iron for over a hundred years. The excellent adherence of enamels to a sandblasted gray iron surface has been an important factor in their popularity. Enamels differ from organic coatings in that they are completely composed of inorganic material, resembling glass in composition, and must be fused onto the casting at high temperatures.

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confer almost complete chemical and corrosion resistance. Acid-resistant enamels are used which can resist all common acids except hydrofluoric. The resistance to alkalis, though not quite as great, is sufficient for many applications. Of almost equal importance is the extreme hardness and scratch-resistance possessed by the vitreous enamel coating, permitting the use of enameled castings in positions where abrasion would quickly destroy an organic coating. Vitreous enamels possess the further advantage that they are highly attractive finishes ranging from very high gloss to matte and can be easily produced in a wide variety of colors. Because of their refractory base, they can be used at high temperatures (600°-1000° F) without discoloring or heat cracking, and can successfully withstand rapid changes in temperature without damage[90, 93].

Applied Wet or Dry

Vitreous enamels consist essentially of: (1) refractories (silica, feldspar); (2) fluxes (borax, soda ash, cryolite, fluorspar, sodium nitrate, zinc oxide, and lithium compounds); and (3) opacifiers (oxides of titanium, antimony, zirconium, and tin) with, if desired, pigments (usually colored oxides of cobalt, iron and their like[91]). They can be applied by either the wet or the dry process.

The wet process involves suspending the basic enamel (or frit) in a solution of electrolytes in water or an organic solvent, and then either dipping or spraying the enamel onto the casting. This process can be used on any size casting, but is usually applied to medium weight and small castings. Although some one-coat enameling is done, it is more usual to apply three coats. The coats are generally thinner and more opaque than in the dry process. Because they are dipped or sprayed on, the process is more flexible than the dry process, particularly where deep pockets, etc. are encountered. Firing temperatures rarely exceed 1450° F.

The dry process consists of dusting dry, finely divided enamel on a previously dipped or sprayed ground coat of a casting heated to around 1600° F, the casting then being returned to the firing furnace. The dry process is generally preferred for large castings, such as bath tubs. In the case of multiple coats, economy in heating can be assured in the dry process because the heavy part can be maintained at an elevated temperature between coats; furthermore, if blistering occurs, the blister can be broken and dusted again with enamel[91]. Firing temperatures are higher (up to 1700° F) to assure flowing of the dry enamels. In general, the enamel thickness approximates 0.04-in. and is materially greater than in the wet process. The final dry enameled surface possesses a higher gloss than when the wet process is used[92].

Cast irons in a wide range of composition can be enameled. Good foundry practice and a surface free from pinholes is as important as analysis. In general, it is advisable to keep the combined carbon fairly low (approximately 0.40 per cent) and avoid alloys that affect carbide stabilization. Sound castings that can be sandblasted to a fairly smooth surface are naturally required[90, 91].

Design of castings intended for enameling is important. Care should be taken to avoid castings with uneven section thickness, as these will not heat up uniformly during firing and thus may cause blistering of the enamel. Corners, both inside and out, should be rounded and the radii of fillets should be generous[90].

Either sandblasting or blasting with a mixture of sand and steel grit is preferable to shot-blasting or grit-blasting alone. If the casting has been coated with oil or grease, has been stored in a damp place and thus absorbed moisture, or contains chilled spots or a chilled skin on certain surfaces, it should be annealed for several minutes at 1300° F in the enameling furnace. In fact, some enamelers regularly anneal at 1200° F to degrease and stress relieve before sandblasting[92].

Offer High Resistance

Vitreous enameled castings, although firmly entrenched in applications such as sanitary ware, have not received recognition commensurate with their high resistance to service hazards. The advantage of castings starts in the enameling furnace where their design is such as to make them much less subject to warpage and distortion than wrought, sheet or welded assemblies. The final enameled casting, because of its resistance to flexure and its high vibration absorption, is also much more resistant to disastrous flaking of enamel than thinner wrought steel parts. This is emphasized if a heavy object is accidentally dropped on a gray iron tub or basin. In such a case, damage is normally limited to a nick in the enamel of the casting as compared to removal of a sizable flake in the case of a wrought enameled object.

Gray iron castings finished by vitreous enameling have found wide use in industry and in the home. Perhaps the most familiar examples are gray iron bathtubs, basins, sinks, stove parts and hospital ware where resistance and sanitation requirements are at a maximum. Many applications in the chemical industry have been found, including rolls, piping, processing and containing vessels of all sorts (popularly called "glass - lined") and miscellaneous equipment[94]. Development of new enamels and improved enameling procedure should expand the potential usefulness of gray irons so coated to industry.

Chemical Conversion Coatings — Chemical conversion coatings, as the name implies, are formed by the conversion of the iron or of one or more of the alloying elements on the surface of a casting into a metal compound, usually by immresion in a solution or exposure to a particular atmosphere. They have proved valuable for many special applications involving such characteristics as attractive appearance, wear resistance, heat resistance and ability to bond organic coatings to a metallic surface. The coatings are, in general, thin and somewhat porous, and, therefore, do not provide any substantial corrosion protection unless a subsequent layer of oil, wax, varnish or other organic finish is applied.

Oxide Coatings: This process depends basically on transforming the surface of the casting to ferric oxide (Fe_3O_4) and inhibiting the formation of ferrous oxide (Fe_2O_3), the latter being the red rust that usually forms on ferrous materials. A tight, black film can be produced which is highly wear resistant in certain applications, and, if waxed or periodically oiled, is fairly resistant to corrosion. The wear-resistant quality of this finish has brought about its use in such applications as gray iron tappets and piston rings, and the attractiveness of the black finish, especially when oiled or waxed, gives it value wherever decorative qualities without any great corrosion resistance are required. The oxide coating in itself is also a good bond for paint or lacquer.

Many of the conventional blackening processes marketed for steel are not suitable for gray iron. It is usually advisable, therefore, to consult the manufacturer of an untried solution as to its applicability to gray iron.

Phosphate Coatings: Probably the most important of chemical conversion coatings are the phosphate coatings, consisting essentially of a layer

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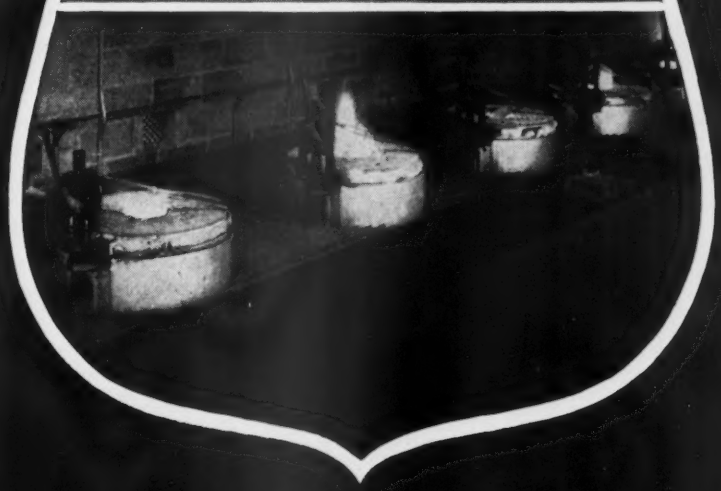

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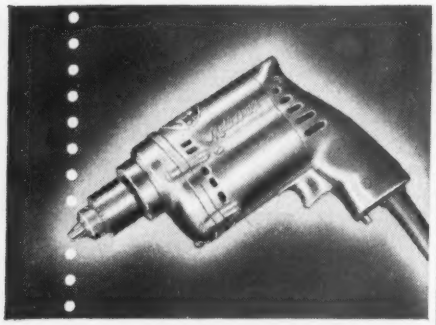

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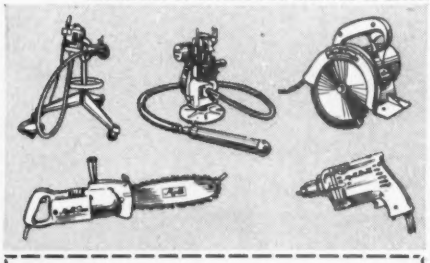

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of iron phosphate crystals plus zinc or manganese phosphate crystals. Phosphate surface layers on gray iron are of interest for several reasons. For example, since they are chemically neutral, they protect the surface from progressive corrosion by the atmosphere; the surface is an excellent base for paint, and they aid in preventing seizing of wearing parts during "break-in."

Phosphate coating processes are simple and no special precautions are necessary for gray iron. The surface should be machined or sand-blasted, and freed from any incidental oil, grease and finger marks, usually by immersion in an alkaline cleaner. The phosphatizing solutions themselves are proprietary, but in general, they consist of zinc or manganese phosphate, free phosphoric acid and accelerators. Thin zinc phosphate coats for paint-bonding are usually sprayed on the casting while thicker coatings are produced by dipping the casting. For small parts, rotating barrels are often used. Phosphatizing operations must be conducted at elevated temperatures (180°-210° F)[95].

Nitride Coatings: Nitriding or nitrogen hardening of gray iron has been used particularly in the British automotive industries[96]. This process imparts a wear-resistant, hard (900-1000 brinell) surface layer, and some corrosion resistance to the gray iron, thereby adding considerably to the life of such parts as piston rings, cylinder liners, valve bodies in rotary valve engines, special cams, press tools and worm castings.

Since an effective case only results from the formation of nitrides with certain alloying elements present in the gray iron, special compositions have been developed for nitrogen hardening. These special gray irons, for example, usually contain 1-2 per cent each of chromium and aluminum. Molybdenum is sometimes added. The process is carried out in boxes maintained at a temperature of 925-1000° F through which ammonia gas is passed for a period of time varying from forty to ninety hours.[96]

It should be noted that the process is not commonly employed in this country. One company interested in nitriding problems[97] states that because of the unusual alloy combinations required, difficulty is encountered in obtaining consistent results in normal foundry practice. They feel that further experimental work is necessary and should precede any wide application of the process.

Coloring—When corrosion protection is not a primary factor and all that is desired is an attractive finish, many metal coloring techniques are available. There are literally thousands of these processes,[98] but unfortunately very little information is available as to their applicability to gray iron. To be sure of a good black finish, the best procedure is probably to employ one of the oxide or phosphate processes. A few other methods of coloring gray iron will be mentioned here, almost all of them dependent upon a previously deposited coating of some other metal. It is to be remembered that these coatings are almost invariably very thin, providing little or no protection against corrosion, and, in general, a wax or lacquer should be applied over the surface.

A good blue color on gray iron can reportedly be produced[100] in a bath consisting of 1 oz/gal lead nitrate, 0.5 oz/gal ferric nitrate and 4 oz/gal sodium hyposulphate.

The so-called "oxidized" finishes, which are in reality sulphides, can be formed by first plating with a thin coating of copper (approximately 0.0001-in.) from the cyanide bath and then dipping the casting in a dilute solution of ammonium, potassium, or sodium sulphide. A wide range of browns and grays, as well as black, can be produced in this manner. The sulphides, however, are not stable and local discoloration may take place. The selenious acid, lead oxide, and steel bronze methods are used to a lesser extent.[98, 99] The black nickel type of coating may be used to provide an attractive finish over a previously deposited layer of copper, nickel, brass, cadmium or zinc.

A more recent development is the "Electro-Color" process which also depends on the previous deposition of a layer of copper. Over this layer another coating extremely thin from a proprietary organic bath is deposited. If the operation is carefully controlled, almost any desired color can be obtained.[101]

Cement Lining and Armor—Cement lining is one of the most effective and economical methods of protecting gray iron castings, such as pipe, against corrosion by fresh and salt waters. Casting surfaces form an excellent base for such a lining, and excellent protection can be obtained with thinner layers of cement than are required in the case of steel pipe. Although the cement is originally somewhat porous, water seeping through the lining tends to form corrosion products which, in turn, appear to react with constituents of the cement effectively plugging the pores and preventing or inhibiting further corrosive attack.

With brines or salt water, alumina type cements are recommended by some authorities.[102] Some specifications include spraying, dipping or brushing a seal coat of water-proof bituminous paint over the cement lining. Such a seal coat will prolong the life of the lining and is particularly necessary in contact with waters corrosive to calcium carbonate, such as water which is of low alkalinity.

There are two usual methods of lining cast iron pipes. The first involves lining of new pipe by the manufacturer and is covered by ASA Specification A21.4-1939.[103] This specification provides for the use of portland cement or suitable hydraulic cement mortar of not less than one part of cement to one part of dry sand by volume. It provides that "Straight pipes shall be lined by the centrifugal process, combining high speed spinning and vibration, or by some other process producing linings which are equal to such centrifugal linings in accuracy of surface contour, smooothness of surface texture, density, low water absorption, and freedom from shrinkage cracks and loose spots. Fittings shall be lined by such process as will produce linings equal, as nearly as practicable, in the above enumerated respects to the linings of straight pipes." These specifications require thickness of lining from ⅛ to ¼ in., depending on diameter.

Pipe Lined Underground

In the second method pipe is lined in place underground in accordance with AWWA Spec. 7A.7-1941. It consists of cleaning of the pipe of all tuberculation and applying a cement mortar lining of one part portland cement and one part sand, 3/16 to ¼ in. thick, to the inside surface of the pipe by the centrifugal method. The process is applicable to pipe 24 in. in diameter and larger.[104] With smaller pipe up to 16 in. in diameter another process is used. In this latter process the pipe is cleaned and a predetermined quantity of cement mortar is placed in the pipe, following which a mandrel is drawn through the pipe which places a smooth continuous lining on the inside surface of the pipe.

Cement lining is reported to prevent tuberculation with the attendant loss in carrying capacity of pipe lines. Lined pipes have a record of over 100 years of tubercular-free service.[104] Cement lined pipe has become increasingly popular in recent years. Use of cement for other castings beside pipe and fittings obviously possesses attractive possibili-

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ties where such linings can be employed advantageously.

Some use is made of cement, or rather concrete armor, for outside coatings of pipe. This armor varies usually between ¾ and 1½ in. in thickness. The armor is reported to be distinctly superior to asphalt and pitch enamels in protecting the outside surface of the pipe from severe underground corrosion over extended exposure periods. It has proved particularly useful in contact with swamps or other low, wet areas, brackish or salt marshes, severe alkali soils, old dump heaps, cinder fills, and other corrosive locations.

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Sources of Illustrations

Figs. 18, 22—Harris-Seybold Co., Cleveland.
Fig. 19—Dayton Casting Co., Dayton, O.
Fig. 20—Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.
Fig. 21—Picker X-Ray Co., Cleveland.
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Fig. 25—Heatbath Corp., Springfield, Mass.
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Fig. 27 — Mitchell-Bradford Chemical Co., Stratford, Conn.
Fig. 28—Parker Rust Proof Co., Detroit.
Figs. 29-31—American Cast Iron Pipe Co., Birmingham.

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Time, Temperature Effect on Baked Core Strength

(*Continued from page* 119)

ratio between the time necessary to complete a reaction and the temperature at which the reaction takes place. This is also true of core baking.

The process of polymerization is the final step in baking a core oil. As there is only so much oil in a core sand mixture, and as this reaction must go to completion, the temperature of the baking process and the baking time are extremely important if complete efficiency is to be obtained in the operation. This also points to the necessity of using only the minimum of oil required to produce the desired result as a method of reducing baking time.

To save baking time and minimize the chances of any unwanted reaction, it is desirable to use a core oil which is properly balanced structurally so that, when the proper temperature is applied, each part of the oil will react in the same way. It is also important that the rate of heat application for a given core oil should be such that the proper sequence of reactions takes place.

Determine Best Conditions

The purpose of this investigation was to find the optimum time and temperature that produced the greatest strength in different core sand mixtures.

Various types of oils may be used in cores, but a commercial linseed base oil designated as oil No. 1 was used in this study. The cereal binder used was a commercial grade of corn flour. The sand was No. 70-80 silica sand, and the wood flour was a high-grade 100-mesh maple type. The wood flour used does not act as a binder, but should be called a filler. Wood flour has very little adhesive strength but serves instead to reduce the hot strength of the core body as a whole. Its usefulness lies in softening or weakening the core to render it more collapsible under shrinkage of the cooling casting. Wood flour in the sand mixture serves as a guard against over-ramming, the particles of wood acting as a cushion and resisting the packing effect caused by ramming.

The mixtures used in this experiment are shown in Table I. Mixture No. 1 contained core oil in ratio 80-1, cereal binder 240-1 and moisture 2.5 per cent. Mixture No. 2 contained core oil in ratio of 100-1, cereal binder 240-1 and moisture 2.5 per cent. Mixture No. 3 contained core oil in

ratio of 120-1, cereal binder 240-1 and moisture 2.5 per cent. Mixtures Nos. 4, 5 and 6 corresponded to Nos. 1, 2 and 3, respectively, but 1 per cent wood flour was added to each mixture, the chief purpose being to see how much strength was sacrificed.

The order of mixing was sand, binder, oil and water in batches of 15 pounds. The mixer was a laboratory type of capacity up to 50 pounds.

After the mixtures were mulled the standard AFS hour-glass-shaped tensile cores and the 1 x 1 x 8 in. transverse bars were rammed. Three specimens of each mixture were rammed to obtain an average.

The cores were then baked in a thermostatically controlled oven for one, one and a half, and two hours at temperatures of 375° to 450° F in 25° intervals. They were broken as soon as they reached room temperature to prevent absorption of moisture.

The results obtained were plotted, as shown on the accompanying charts.

Wood Flour Affects Strength

It will be noted that the optimum temperature for mixture No. 1 is 425° F and that it has a steady climb from 119 psi tensile strength at one hour to 176 psi at two hours, which is the optimum time. Mixture No. 2 also falls into this temperature and time range, for its peak is 140 psi at two hours. Mixture No. 3 at 450° peaks at one hour and falls off; this mixture has the least oil concentration (120-1). Throughout the temperature range its peak is at one hour from 400° to 450°. At 375° it peaks at two hours' baking time. If we add 1 per cent wood flour to mixture No. 3 the peak strength changes. At one hour only the 450° temperature gives a peak, while at 375, 400, 425° strength is still climbing at one and one-half hours.

The charts show that the addition of wood flour gives a very slow rising flat curve which will give maximum strength for a greater period of time. It should also be noted that, as the temperature is increased, the more critical is the maximum strength peak. Although mixtures Nos. 4, 5 and 6 show lower strength, they will improve with a small addition of core oil, because the wood flour absorbs some of the oil in the mixture. The core oil in 4, 5 and 6 was kept constant with 1, 2 and 3 to note the effect of wood flour addition.

In studying the tensile strength curves it will be seen that most of the cores taken from the oven just

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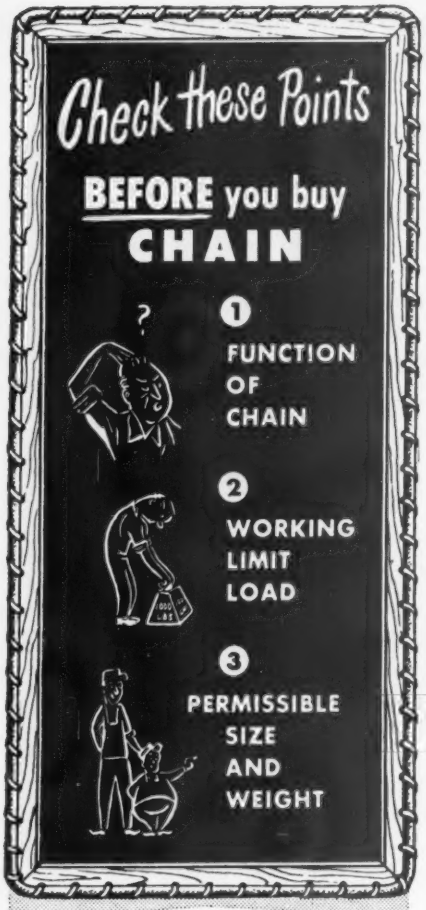

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before reaching maximum strength, or in an underbaked condition, will match, in tensile strength, cores which have passed maximum strength.

It will also be noted that, as the temperature increases, the time range over which maximum strength is attained becomes less and less. This indicates that the higher the temperature used, the more critical is the point at which the cores must be withdrawn from the oven and the greater attention that must be paid to the core baking cycle to achieve the bast results. It also demonstrates that production of cores of maximum strength might be increased considerably by proper attention to oven technique.

Modernized Foundry Gains Efficiency and Capacity

(*Concluded from page* 97)

muller, the quantity being controlled by means of calibrated meters. Electrical and mechanical timers regulate mulling action accurately.

Foundry — The existing foundry building was extended 120 feet to permit relocation of the cleaning room and stress relieving furnaces for a "straight line flow" of the production operations—ramming, mold drying, coring, pouring, and cleaning. Another part of this modernization was provision for a flask storage yard, 50 by 102 feet, and adequate in capacity for efficient arrangement of flasks. This yard, shown in Fig. 10, is completely separated, but accessible to the main bay. Track cars, loaded and unloaded by overhead crane, move flasks in and out of the foundry quickly and efficiently. Pattern storage facilities were also enlarged so that large patterns can be stored at ground level with loading car access to the main bay of the foundry.

Two car bottom type annealing furnaces, pictured in Fig. 9, relieve stresses in the castings. Heat treating temperatures are accurately maintained by controllers on conveniently located panels. One of these furnaces is a new one of recirculating air type and has a program control by modern recording controllers. They follow a predetermined thermal cycle automatically to produce the desired metallographic structures.

Sand loss is minimized, manual operation is eliminated, and air contamination is prevented by new mold shakeout equipment, shown in Fig. 8. Vibration of this mechanism loosens the sand and allows it to drop through the table grating into the feeder for a revolving barrel or cylinder approximately 6 feet in diameter and 37 feet long. This barrel riffles and cools the sand, adding water automatically when necessary by means of a thermostatically actuated valve. The sand is screened at the exit end of the barrel, thus removing and depositing wires, gaggers and other foreign matter into a tote box.

The sand passes through the screen and feeds onto a conveyor belt that deposits it into a vertical elevator. A magnetic pulley at the elevator further rids the sand of any small shot, nails or wires that may escape the screen. At the top of the elevator the sand is deposited onto a belt that carries it above large steel storage hoppers, where it is plowed off into predetermined sections above the mulling system. The elevator also carries new and special sands.

New and old sand in these overhead steel hoppers can then be weighed in proper proportions by means of a moveable weigh lorry traveling under all bins and dropping into a molding sand muller. Water and the various binders for the sand may then be added. Automatic timers and regulators control the mulling cycle.

Eliminate All Dust

The mulled sand is ejected from the muller onto a belt conveyor where it is transferred to an elevator and then to distributing belts, which supply sand to various molding stations and hoppers.

Dust and fumes produced by the shakeout are disposed of by an exhaust fan and two modern wet type dust collectors, thus preventing air contamination and improving working conditions not only at the mold shakeout but also throughout the foundry. Similar equipment is used with the core knockout shaker, which deposits core sand on a metal apron conveyor for transfer to overhead bins for future disposal.

Molding sand, like core sand, is received dry in closed box cars. This sand is plowed out of the car into a hopper where it is picked up by a mobile conveyor belt and deposited into an elevated hopper, as shown in Fig. 2. This hopper feeds an enclosed conveyor belt that carries the sand to the top of concrete storage bins, where it is plowed off into stalls of sufficient capacity for winter storage.

Sand handled by the sandslinger, shown in Fig. 7, is received from an overhead hopper fed by belt conveyor. The slinger serves numerous stations along a track running the full length of the molding floor.

A Theoretical Basis for the Design of Gates

(*Continued from page* 117)

runner is fed by a very short sprue, which is always twice the runner diameter, to insure a filled runner. metal is introduced into the sprue through a pouring cup. The dry sand core is placed on a sand slab, which has cavities scooped out of its surface, to catch separately the metal from each gate. A small dam is located at the end of each gate, its purpose being to insure that the gate will be filled with metal throughout the entire test or run.

This dam was omitted in earlier tests and considerable difficulty was experienced in obtaining reproducible data. It was decided that this was due to certain gates not being filled with metal, and the use of the dams seemed to confirm this, because the reproducibility was considerably improved thereby. Furthermore, in an actual casting the metal stream generally discharges from a gate into a body of liquid metal in the mold cavity. This condition is more closely simulated when the dams are used than when they are not.

A test consisted of pouring 100 to 300 pounds of molten steel through the gating system. The discharge from each gate was collected separately and weighed after being allowed to cool. It will be remembered that the equations developed earlier predicted the *ratio* of the volume rate of flow from a particular "T" gate to that from the first or "L"-gate. The experimental data was, therefore, reported as *weight ratios*, such as W_{G2}/W_{G1}, W_{G3}/W_{G1}, etc. It is evident that the ratio of volume-rates of flow are equal to the ratio of weight-rates of flow, which in turn is equal to the ratio of the total weights of the individual discharges from the various gates. Therefore, the terms Q_{G2}/Q_{G1} and W_{G2}/Q_{G1} will be used interchangeably.

Effect of Absolute Size—The equations developed above predict that the discharge ratio is determined by the *ratios* of gate areas to runner areas. This implies that the *absolute size* of the gates and runner is not significant; that is, a 1-in. runner with two 1-in. gates would give the same discharge ratio as a 2-in. runner and two 2-in. gates.

To test this hypothesis, a number of gating systems were used, all the runners of which had equal length-to-diameter ratios, L/D (this will be explained in the next section). The gate-to-runner area ratios were kept at 1, for various absolute runner diameters. The discharge ratios ob-

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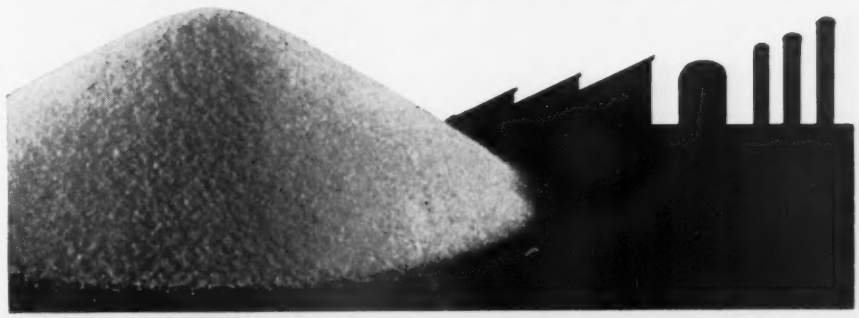

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tained are shown in Table II. It will be seen that the discharge ratio is, in fact, determined only by gate-to-runner area *ratios* and not by absolute size.

Effect of Runner Length—The reader will remember that the expressions derived earlier for the various discharge ratios contained no reference to length of the runner between the gates. This arose from the fact that we were using a form of Bernoulli's equation in which the effect of pressure drop due to friction was neglected. The phenomenon of friction in a liquid flowing in a hose is such as to cause the static pressure, p, or static head, h, to decrease as the liquid flows along the hose. The same would occur with water flowing in a runner of a gating system. Fig. 7, line A, shows what would happen in this case.

For any particular flow rate in a given runner, the pressure drop between the two gates due to friction would be proportional to the ratio of the length of the runner to its diameter, or L/D. The line A is, therefore, a straight line slanted downward to the right, to show the falling pressure. The problem of friction pressure drop in molten steel is more complicated, however, than the similar problem for water. This is because friction pressure drop stems from the viscosity of the liquid. In the case of water, the viscosity is constant as the water flows along the pipe. In molten steel, however, the viscosity rises as the steel flows along, due to the falling temperature of the stream. So the curve of pressure versus distance flowed will drop off at an increasing rate—it will curve downwards. This is shown as line B in Fig. 7.

However, in the manifold gating system there is a tendency for the pressure to rise from gate 2 to gate 1. This tends to make the flow from gate 1 greater than that from gate 2. This is shown by line C in Fig. 7, which describes the ideal, or theoretical case. This increase in pressure at gate 1 is due to the inertia of the liquid. The reader will remember that Bernoulli's equation related velocity and static pressure or head. The rise in pressure at gate 1 is due to the sudden decrease in velocity of the liquid at that point. This is an inertial effect, which stems from the density of the liquid, and not at all from the distance between the gates. We can consider the sum total pressure change between gates 2 and 1, therefore, (to a first approximation) to be the sum of the two separate changes as shown by lines B and C. The sum of B and C is shown as line D.

We are now in a position to theorize about the effect of distance between the gates on the discharge ratio for the two gates. We see from Fig. 7, line B, that as the distance increases, (or as L/D increases) the pressure just inside gate 1 tends to drop, and at some value of L/D, the effect of friction is great enough to cancel (and then more than cancel) the increase in pressure due to the inertial effect. Conversely, for a short runner, the friction effect will be quite small, and the rise in pressure will be very close to that computed from Bernoulli's equation (line C). Therefore, a question remains: "How long must a runner be to cause appreciable departure from the discharge ratios computed by the simple theory used above?" Whereas the answer could be computed directly and simply for a liquid like water, the answer for a liquid like molten steel, with its variable viscosity, could be best arrived at by experiment.

Experiment With Gates

The experiment consisted of pouring a number of heats through gating systems of the type described in the previous section, and shown in Fig. 6. The gating systems used had two gates with diameters equal to that of the runner. That is, both gates had area ratio $A_G/A = 1$. Two runner diameters, D, and three runner lengths, L, were used, and the discharge ratios were plotted versus L/D. The results are shown in Fig. 8. It will be seen that up to L/D = 16, there is no apparent effect of distance between gates on discharge ratio. Such a runner might have, for example, a diameter of 1½ in. and a length of 1½ × 16 = 24 in. It was decided that an L/D of 16 was large enough to include a wide variety of shop conditions, so no larger values of L/D were measured.

We might compare the results for steel with the results of similar tests on water and mercury. These results are shown in Fig. 8. Since the frictional effect depends on viscosity and the inertial effect on density, it is useful to try to interpret the results with the three liquids in terms of the ratio $\mu/\rho = \nu$. Here μ is called the *absolute viscosity,* (this is what is usually meant by merely "viscosity") and ρ is the density of the liquid. The ratio is, therefore, in a certain sense the ratio of the viscous or frictional effect to the inertial effect. This ratio, ν, called the *kinematic viscosity,* equals 1 cm²/sec

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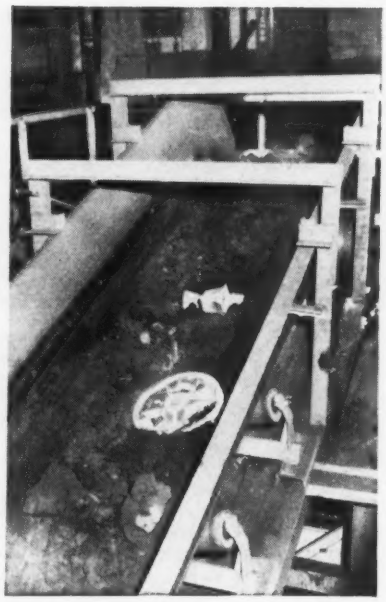

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for water, and about 0.118 cm^2/sec for mercury. It will be seen that the discharge ratio for water rises sharply above L/D of about 13, while it is constant for mercury up to L/D = 18. Molten steel has a kinematic viscosity of about 0.28 — 0.41 cm^2/sec, and therefore might be expected to have a behavior intermediate between water and mercury. These conjectures are shown as the dotted portions of Fig. 8A and 8C.

Experimental Results for Three Gates—It will be noted that the equations in Table I indicated that $W_G/W_{G1} = Q_G/Q_{G1}$ for a particular gate are independent of the gates upstream of the gate under consideration. That is, the ratio Q_{G2}/Q_{G1} is independent of the sizes of gates 3, 4, etc. This is also true for Q_{G3}/Q_{G1}, Q_{G4}/Q_{G1}, etc. Experimental evidence is shown in Table III to confirm these theoretical results. It will be seen here that the ratio Q_{G2}/Q_{G1} is the same whether or not a third gate is present. This should not be interpreted to mean that the *total flows* are the same. When a third gate is added to a doubly-gated runner, the total flow rates through the first two gates decrease, but the *ratio* of flow rate remains constant.

To illustrate this, lines *A*, *B*, *D*, *E*, *Q*, *R*, and *S*, of Table III show the experimental values of Q_{G2}/Q_{G1} for cases in which there are three or more gates. These same values of Q_{G2}/Q_{G1} were found with gating systems with only two gates. That is, the third gate does not change the flow ratio from the first two gates. Analogously, the fourth gate does not change the flow ratios from the first three gates; it was found experimentally that the same flow ratios occurred whether or not there was a fourth gate upstream of the first three.

Discharge Coefficients—Now that certain preliminary cautions have been taken to make sure that the theory developed at least has the proper form, and that it tends to explain qualitatively certain gross effects, it is possible to compute some discharge coefficients. The values of the discharge coefficients were obtained somewhat by the following reasoning. If k is known for the various gates of a multiple-gated runner, then it is possible to compute the ratio of discharges for any combination of gate sizes. Conversely, if one knows the discharge ratios for a large variety combination of gate sizes, then it should be possible to find (even if only by trial and error) values of the discharge coefficient, k, for each gate, which will reproduce the data.

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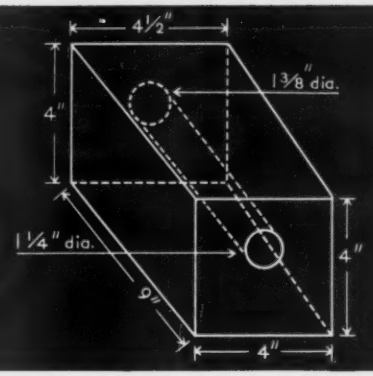

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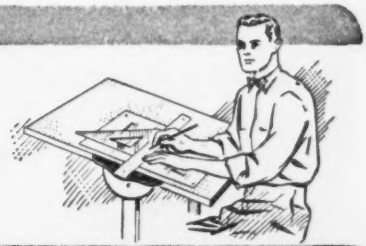

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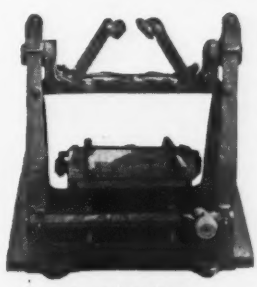
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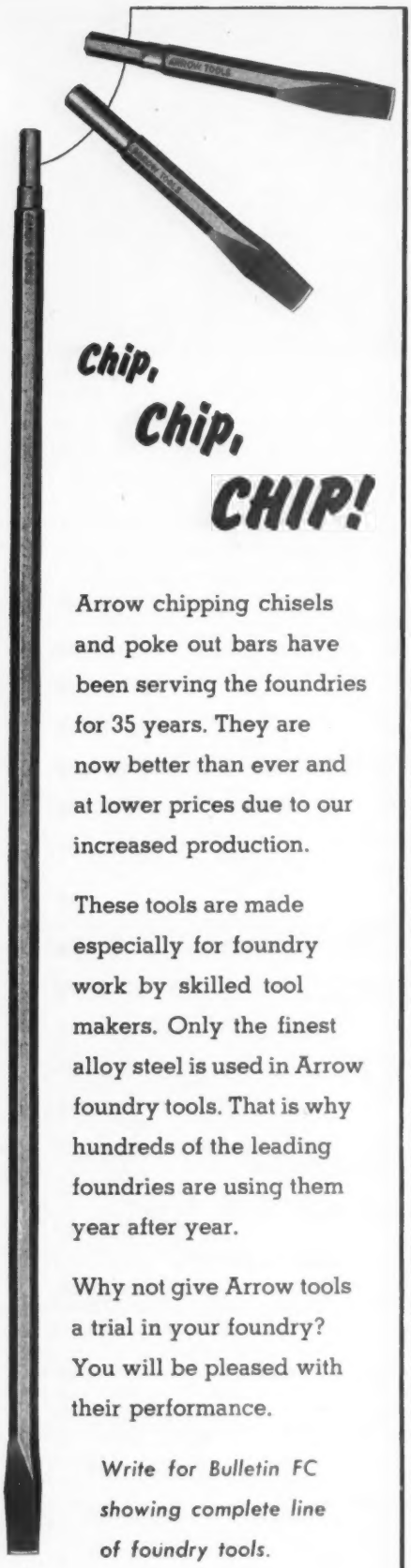

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technique is based on a series of experiments which are at present under way. In these experiments, the actual total rate of flow is measured through the entire gating system. This is done by measuring the rate at which the metal level rises in a simple mold cavity fed by a multiple-gated runner under controlled conditions. This information, together with the above-mentioned discharge ratio data, can be used to compute values of discharge coefficients. Results of this branch of the investigation will be presented at a future date.

At any rate, values for the discharge parameter kA_G/A, have been computed by the first method, and are shown in graphical form in Fig. 9. It will be seen that two curves are shown, one for "L"-gates and one for "T"-gates.

The use of these curves can be illustrated by means of an example. Suppose that it is desired to compute the flow distribution from a gating system consisting of a 1½-in. runner, and three 1-in. gates. The gate-to-runner area ratios for all gates are $\frac{(\pi/4)\,(1)^2}{(\pi/4)\,(1.50)^2} = 0.445$.

The values of kA_G/A are found from Fig. 9. The value of k_GA_G/A for the "L"-gate is seen to be 0.370, and for the two "T"-gates is 0.345. These values are inserted into the appropriate expressions found in Table I.

$$\frac{Q_{G2}}{Q_{G1}} = \frac{0.345}{0.370}\sqrt{1-(0.370)^2} = 0.866$$

$$\frac{Q_{G3}}{Q_{G1}} = \frac{0.345}{0.370}\sqrt{1-0.370+0.345\sqrt{1-(0.370)^2}^2} = 0.372$$

That is, the ratio of the flow rate from gate 2 to that from gate 1 is 0.866, and the ratio of the flow rate from gate 3 to that from gate 1 is only 0.372. These values are valid *only* for the case in which all three gates empty into a single cavity. These numbers are not meant to apply when each gate feeds a separate cavity; that case is more complicated, and while it can be computed from the values of kA_G/A, treatment of such cases is reserved for the future. The point of the example just given is that the foundryman would be very mistaken, indeed, if he expected the gating system described to deliver equal flows from all gates. If it were desired to have equal flow through all gates, the gating system should be redesigned so that the "L" gate was, say 15/16-in. diameter, gate No. 2 diameter was 1 in., and gate No. 3 diameter was 1¼ in. Let's see how this system behaves with a runner diameter of 1½ in.

Gate		A_G/A	kA_G/A	Flow Ratio Q_G/Q_{G1}
"L"-gate	1	0.390	0.330	1
	2	0.445	0.345	1.05
"T"-gate	3	0.697	0.433	1.145

The system could be designed to give flow-ratio values closer to 1, but these values are probably close enough for shop use.

Experimental vs. Predicted Values—It should not surprise the reader if the experimental values check well with the predicted values, since, after all, most of the experimental values of flow ratio were used in computing the values of kA_G/A. The comparison is shown in Fig. 10, a plot of computed values of flow ratio versus the measured values. These values are plotted in three graphs for Q_{G2}/Q_{G1}, Q_{G3}/Q_{G1}, and Q_{G4}/Q_{G1}. In each graph a line is drawn with a 45° slope to represent a perfect "fit" between measured and computed values. It can be seen from Fig. 10 that the flow ratios computed from the theory fit the measured values quite closely, indicating that generally consistent values of the flow ratio Q_{G4}/Q_{G1} is good.

Attention is called to points in Figs. 10B and 10C for which the computed values of Q_{G3}/Q_{G1} and Q_{G4}/Q_{G1} equal zero. The small flows reported are felt to be the result of splashing, etc. Actual observation of the flow through these gates during pouring substantiated this view, since the flow was extremely erratic, and was actually zero for long periods. It should also be mentioned that computation indicated these points to be just on the borderline of zero or reversed flow. The authors have actually observed instances in other work in which the flow through a gate has been absolutely zero, while gates downstream delivered metal.

Using the Equations in Gate Design—The reader might feel that all of the foregoing is of interest only from a theoretical standpoint. To demonstrate its practical significance the developed equations will be used to dimension the gating system of a particular casting.

The sample casting will be simple, a rectangular plate with a heavy section at one end, and is shown in Fig. 11. The manifold system used

here is often necessary due to space limitations in locating the sprue in the flask. It would be desirable, of course, to use a single gate into the heavy section. This would result in the coldest metal going to the thin end of the casting, with directional solidification resulting, towards the thick section and the head. However, in many cases, the plate will be so long that if a single gate into the thick section were used, misrun would occur at the far end of the plate. This makes it necessary to supply liquid metal at the thin end as well as at the thick section.

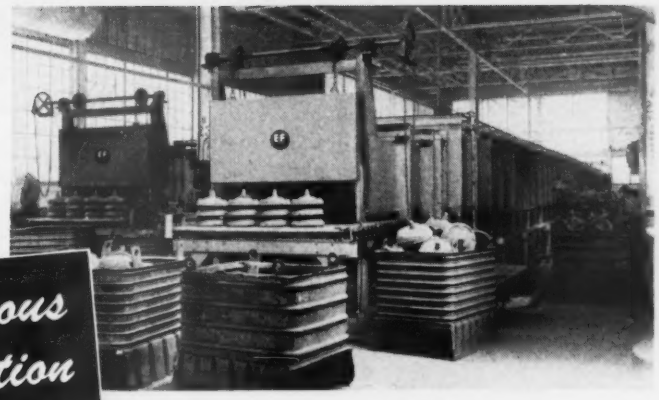
So this is the problem: How much metal should be introduced into the thin end of the casting, and how much into the heavy end? Though it will be colder than the metal entering through No. 2 gate, the metal entering through No. 1 gate will be hotter than if it flowed there through the mold cavity. If too much metal is fed into the thin end, it will tend to nullify directional solidification to a certain extent. Therefore, it is desirable that the *minimum* amount of metal necessary to eliminate misruns be allowed to flow through No. 1 gate.

FOUNDRY Index Ready

Index to FOUNDRY, Volume 78, listing by title, subject matter and author the editorial material published during 1950, is available for distribution. Subscribers may obtain copies on request.

At this point, experience is necessary to guide the foundryman in his choice of flow ratio through the two gates. While the choice in this example may be different from what the reader might make, it will show him how he can design this gating system to *his own* flow specifications. Our approach will be first to consider the maximum plate length which could be run with only one gate in the heavy section. This length might be 18 in. We, therefore, have to gate for an additional 6 in. of plate. A flow ratio equal to the volume ratio of the two sections is then chosen. This is shown in Fig. 11. This flow ratio represents the *minimum* amount of metal commensurable with filling the extra 6 in. of plate without misruns occurring. Our flow ratio will, therefore, be $Q_{G2}/Q_{G1} = 18/6 = 3$, and we now need to find the necessary dimensions of the gating system to give this flow ratio. Of course, from the data presented, only circular gates and runners can be treated.

The dimension of the far gate, gate



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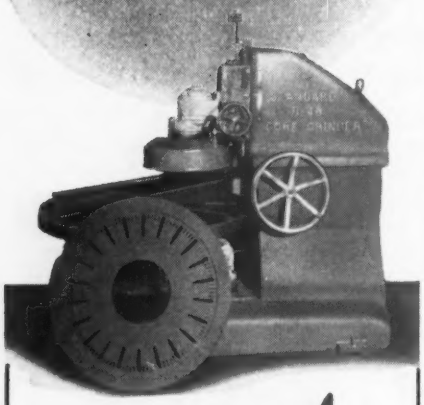

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No. 1, is fixed by the thickness of the plate at ½-in. Furthermore, if it is desired to use the equations given here it will be necessary that the length-to-diameter ratio of the runner between the two gates, L/D, be equal to or less than 16. This follows from the discussion given above on L/D, in which it was mentioned that steel behaves like a true liquid (that is, cooling effects on flow are negligible) for runners with L/D up to 16. Now in our case, we *want* the metal passing through gate 1 to be much cooler. We, therefore, choose a large L/D, to permit the largest cooling effect. Since the distance between gates is 21½ in., and L/D is 16, then the runner diameter *D*, is 1.343 in, standard size 1.375 in. This means that the area ratio for the No. 1 gate is:

$$\frac{A_{G1}}{A} = \left(\frac{D_{G1}}{D}\right)^2 = \left(\frac{0.5}{1.375}\right)^2 = 0.132$$

We obtain the value of kA_{G1}/A from Fig. 9. Since gate 1 is an "L"-gate, and since $A_{G1}/A = 0.132$, the kA_{G1}/A is read from the upper line to be 0.120. We put this value into the equation, taken from Table I, which applies to runners with two gates. For this example $Q_{G2}/Q_{G1} = 3$ (the desired flow ratio) and $kA_{G1}/A = 0.120$.

$$3 = \frac{kA_{G2}/A}{0.120}\sqrt{1 - (0.120)^2}$$

$$\text{or } 3 = 8.27\,\frac{kA_{G2}}{A}$$

$$\text{or } \frac{kA_{G2}}{A} = \frac{3}{8.27} = 0.363$$

Once more we use Fig. 9, this time entering on the left with $kA_{G2}/A = 0.363$. We go across to the line for "T"-gates, since gate No. 2 is a "T" gate, and we read the value of $A_{G2}/A = 0.465$. Gate-to-runner diameter ratio is the square root of the gate-to-runner area ratio, so

$$D_{G2}/D = \sqrt{0.465} = 0.682$$

$$\text{or } D_{G2} = 0.682 \times 1.375 = 0.938 \text{ in.}$$

We choose a more standard diameter size of $D_{G2} = 15/16$".

So now we have the desired gating system: Gate No. 1 diameter ½-in.; gate No. 2 diameter 15/16-in.; runner diameter 1⅜-in.

The runner diameter might be made smaller, which would require the No. 2 gate be made larger (the reader can check this for himself), but the accuracy of the results would be in some doubt, due to the L/D ratio exceeding 16.

If the length of the casting were sufficiently great, three gates might be used, and would be chosen in a manner entirely analogous to the one used above.

Conclusions and Comments

1. Simple theory, based on the principles of conservation of matter and of energy is capable of predicting qualitatively the behavior of liquid steel flowing from a manifold-gating system of circular cross section.

2. Experimental determination of the quantities kA_G/A now permit the quantative prediction of flow distribution from such gating systems.

3. While the data were obtained only for steel is it expected that with suitably determined numerical constants the theory will apply quite well to most liquid metals.

4. It is possible to predict when zero flow will occur through a gate. When this happens, the situation can not be remedied by increasing the size of the affected gate. Instead, it is necessary to decrease the sizes of the gates downstream.

It is not the intention of this paper to suggest how the foundryman design gating systems. Rather, it describes a tool which he can use in conjunction with his experience. It is up to him to decide what kind of flow ratios he wants; he may then try to attain those flow ratios by use of the material presented here.

The reader is to be cautioned, at this point, that while the values of $k_G A_G/A$ presented in Fig. 9 are considered good, more work is being done to improve them. The reader may expect that another article will appear in the future, giving better values of $k_G A_G/A$, and also extending the theory to cover more design applications. Also, as data are collected for half-round, square and other gating systems, it will be possible to treat these systems with the same theory as that used for systems with the round sections.

Acknowledgements—This work was sponsored through a fund established by the American Steel Foundries for research in the field of foundry technology. The authors wish to express their appreciation for the interest and support of this company. Appreciation is also expressed to O. E. Teichman and A. D. Kafadar of the Applied Mechanics Department of the Foundation for their suggestions and help in the fluid mechanical aspects of the work.

Chevrolet - Saginaw Gray Iron Foundry, Tenth & North Washington Ave., Saginaw, Mich., is completing a 60 x 60-ft building to house equipment for compressing steel borings and cuttings into briquets for use in charging cupolas.

Use of Pyrometry in the Nonferrous Foundry

(*Continued from page* 100)

sider safe.

Every foundryman knows that, all other things being equal, the section of the casting that chills the fastest is usually the soundest. It is easier to attain this desirable chilling action in thin-section castings than in large castings with heavy sections and wide variation between section thicknesses. When much feeding of heavy sections must be done, it is impossible to get a heavy chilling action and still feed all parts of the casting. For that reason the casting pouring temperature must be controlled to give the most advantageous temperature rather than the one that will give the greatest chill.

It is fairly well understood among foundrymen that too high pouring temperature will result in shrinkage porosity throughout the casting. The greatest percentage of defective castings found in a number of jobbing and production brass foundries was due to shrinkage porosity caused probably by the combination of inadequate feeding and too high pouring temperature. Consequently, it appears most important to pour the casting over the range of temperature that will give the best feeding and make the soundest casting.

Bronze Castings Leak

Fig. 1 shows a sectioned and polished casting of 85-5-5-5 alloy in which shrinkage porosity was produced by too high pouring temperature. Several thousand castings were made from the same pattern and approximately one-half leaked through the seat area under hydrostatic pressure. Since many good castings also were made from the pattern it must be assumed that the gating was satisfactory.

Regardless of the type of gating and risering used, there is always a single pouring temperature with which the job can be best made. What probably happens is that several effects compensate for each other and the casting is made sound even though the gating might normally be considered inefficient. On the other hand, if this is true—and considerable evidence is available to support it—it means that a well gated casting should have a wide range of temperature available for pouring.

This phenomenon is of prime importance when large numbers of castings must be poured from the same ladle. If the castings are gated prop-

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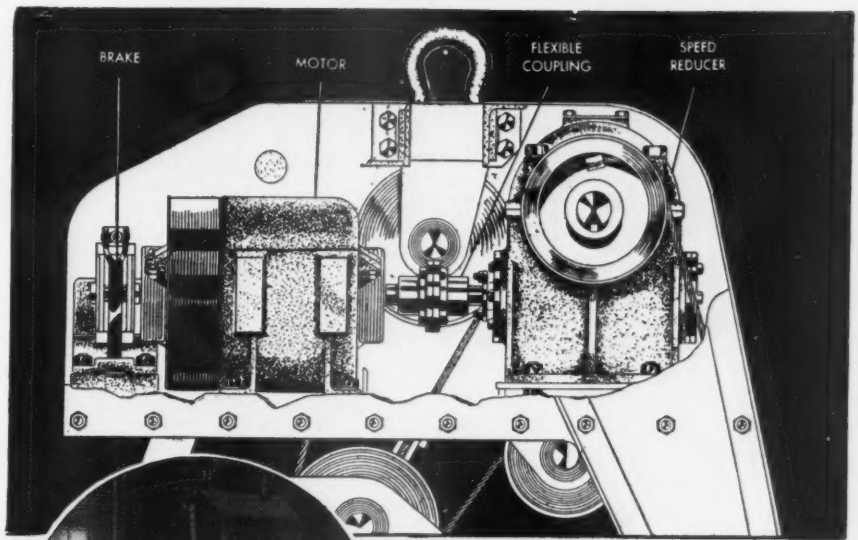

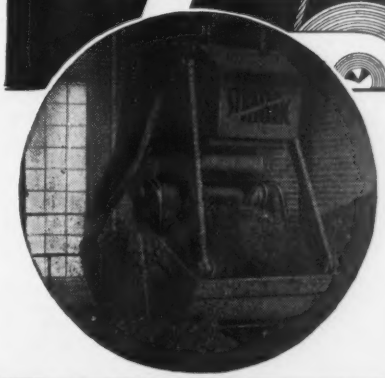

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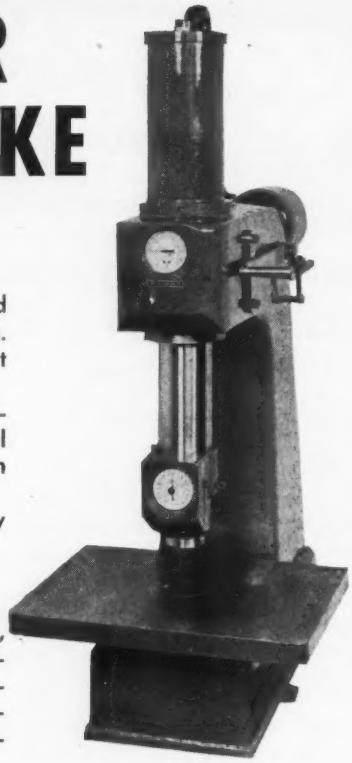

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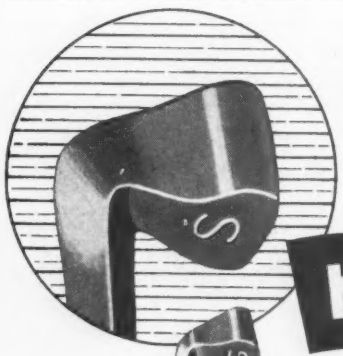

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erly, it should be possible to pour a considerable number of them with the same pot of metal and have minimum effects from the change in pouring temperature as the metal cools during pouring. It has been found in numerous experiments that the greatest number of reject castings in production shops are those poured at the beginning and at the end of a pour. That is, the castings poured with the highest pouring temperature and lowest pouring temperature usually have the most porosity defects, usually from shrinkage. For that reason it is necessary to know precisely the number of molds that can be poured with a beginning temperature and use that information whenever that particular job is made.

What is usually necessary to determine this is a record of the beginning temperature of the pour, the number of molds poured and the temperature of the metal before the last mold is poured. Knowing the elapsed time, it is usually possible to figure out the rate of decrease in metal temperature. Then by marking the castings and following them through the machine shop and inspection, it is possible to find out which molds gave sound castings and which gave unsound castings. By selecting the most advantageous pouring temperature range the number of reject castings can be greatly reduced.

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The essential part of this procedure, however, is to determine the correct pouring temperature range and to carefully measure the temperature of the metal before pouring so that no castings are poured in any other than the desired temperature range.

Effect on Finish—With fixed sand and pattern conditions, pouring temperature will sometimes determine whether or not the casting finish is acceptable. Numerous observations have revealed that castings poured at lower temperatures usually have the best finish. This is understandable when the effects of molten metal on the sand are considered.

(*Concluded on page* 245)

(*Concluded from page 244*)

As the molten metal travels through the mold it heats up the sand greatly. At any place where a considerable quantity of metal enters the mold and goes over a localized area of sand the heat may burn out the bond in the sand and cause the grains to be washed away by the flow of metal. This, of course, can cause surface irregularities in the finished casting.

Generally, the higher the temperature of the metal the more fluid it is. This means that if the pouring and gating system is such that it encourages agitation and turbulence in the mold, then the greater the fluidity of the metal the greater the possibility of carrying the effects of turbulence and agitation into the casting. When the metal pouring temperature is low, the resulting castings usually have a better finish than when the metal temperature and fluidity are high.

Cite Typical Example

Recently an observation was made in a foundry producing castings for paper mills. A bronze casting was made from a matchplate with two identical patterns on the plate. The gating system was so designed that one casting was fed directly from the sprue while the metal backed into the other. When the pouring temperature of the metal was high the surface of the casting near the gate area in both cases was so rough and eroded that the casting was unacceptable to the foundry's customer. As the pouring temperature of the metal dropped, however, the castings improved so that they could be used. The gating system, of course, was responsible for the eroded condition on the casting but the effects of the gating system were minimized when the lower pouring temperature was used. The importance of knowing the exact pouring temperature and using it seems to be evident from observations of this kind.

One other difficulty in using too high a pouring temperature is that most of the copper-base alloys and some of the aluminum alloys have greater tendencies to dross at elevated temperatures. If the metal is poured into the mold too hot it may form dross that will be carried with the metal, and there is a greater chance of finding dirt in the castings. These same alloys poured at a lower temperature or at the lowest temperature that can be used to make a sound casting will frequently show much less dross than when poured at a higher temperature.

(*To be concluded next month*)

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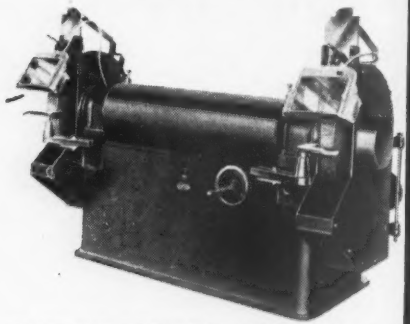

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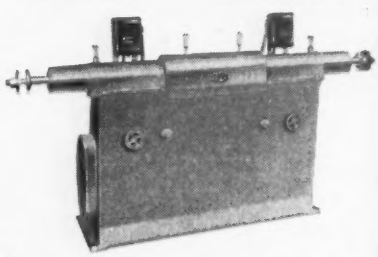

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MATERIAL HANDLING: Rapids-Standard Co., Dept. GC-51, 342 Rapistan Bldg., Grand Rapids 2, Mich.—Catalog GC-51 illustrates and describes gravity conveyors, power conveyors, hand and platform trucks, with accessories including fixed and portable stands, hinged sections, channel or tubular guard rails and various case stops. Catalog contains application tips, construction features and specification charts.

For More Details Circle No. 90—Page 219

SELECTION CHART: Cooper Alloy Foundry Co., Bloy & Ramsey Ave., Hillside 5, N. J.—Bulletin prepared by company's chief chemist aids in selecting most economical material satisfactory for resistance to corrosive media. Carbon steel is included with more expensive materials, listed in table headings which appear in order of increasing cost, to enable selection of most economical material.

For More Details Circle No. 91—Page 219

BATTERY DATA: Gould-National Batteries Inc., 467 Calhoun St., Trenton 7, N. J.—Nine new two-color, 8½ x 11-in. specification sheets cover light, normal and heavy duty batteries for "walkie" type trucks produced by the following manufacturers: Automatic, Barrett-Cravens, Lyon-Raymond, Market-Forge, Moto-Truc, Revolvator, Stuebing, Towmotor, and Yale & Towne.

For More Details Circle No. 92—Page 219

FURNACES: Surface Combustion Corp., 2375 Dorr St., P. O. Box 907, Toledo 1, O.—Bulletin SC-148 covers applications of 5 different furnaces to controlled atmosphere heat treating. Atmosphere generators, burner equipment and other factors are presented. Compositions of most widely used heat treating prepared atmospheres and the generators in which they are produced are also described.

For More Details Circle No. 93—Page 219

TRACTOR SHOVEL: Service Supply Corp., Mfg. Division, Twentieth St. and Erie Ave., Philadelphia 32—Bulletin LO 200 describes a new 1-yd combination overhead and front end shovel for International Harvester tractors sold through that company's dealers. Unit is said to increase loading production by elimination of turns, as many as 1900 per 8-hr shift.

For More Details Circle No. 94—Page 219

WELDING ALLOYS: Eutectic Welding Alloys Corp., 40 Worth St., New York 13—Reference chart TIS 246 P contains specifications on nearly 100 different low temperature welding alloys used in welding, brazing, and hard surfacing of steel, alloy steels, stainless, cast iron, brass, bronze, copper, aluminum, magnesium, zinc die cast, etc. Included is a list of welding applications and the alloys recommended for maximum efficiency in each instance.

For More Details Circle No. 95—Page 219

PORTABLE CORE OVENS: Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13—Bulletin 206 illustrates and describes shelf type and rolling drawer ovens with recirculating heating systems for gas, oil or electricity. Ovens are said to provide fast baking, continuous operation, low fuel consumption and saving on floor space.

For More Details Circle No. 96—Page 219

SALES RECORDS: Management Controls Division, Remington Rand Inc., 315 Fourth Ave., New York 10—Booklet entitled "How To Increase Profitable Sales" describes utilization of machines and systems to compile sales analysis facts and use them for checking sales by individual accounts, by prospects, by salesmen and by territory.

For More Details Circle No. 97—Page 219

MATERIALS CHART: Monsanto Chemical Co., Plastics Division, 812 Monsanto Ave., Springfield, Mass.—Dial-type reference guide on plastics and 11 other structural and fabricating materials gives comparative costs and condensed data on mechanical, thermal, electrical, optical and chemical properties.

For More Details Circle No. 98—Page 219

GRINDING WHEEL BOND: Chicago Wheel & Mfg. Co., 1101 West Monroe St., Chicago 7—Form 2032 covers vitrified bond for grinding wheels and mounted wheels. Folder outlines advantages and applications of abrasive development, claiming a 5 to 10 per cent increase in grinding and finishing output.

For More Details Circle No. 99—Page 219

GAS TORCH: Hauck Mfg. Co., 124-136 Tenth St., Brooklyn 15, N. Y.—Bulletin 1070 presents details on heavy-duty portable gas torch, available in five sizes. Torch heating capacity, minimum and maximum flame sizes are specified.

For More Details Circle No. 100—Page 219

RESEARCH: Silverstein & Pinsof Inc., 1720 Elston Ave., Chicago 22—Research paper entitled "Direct Colorimetric Determination of Copper and Iron in Tin and Lead Base Alloys" has been prepared by the company's analytical laboratory. Detailed information is given on reagents and solu-

tions, calibration and preparation of charts, procedures for copper and for iron, and a table of results.
For More Details Circle No. 101—Page 219

TRAMRAIL SYSTEMS: Forker Corp., 2044 Random Rd., Cleveland 6—Illustrated bulletin 105 deals with cranes, transfer bridge, and tramrail systems, and describes a shielded electrification system for motorizing that equipment. Specification sheets to aid in planning specific systems also are available.
For More Details Circle No. 102—Page 219

SAND MIXERS: Fordath Engineering Co., Hamblet Works, West Bromwich, Staffs., England—Booklet describes company's line of core sand mixers with capacities of 20 lb to 2000 lb. Mixing principle of the blade-type mixer is discussed, specification tables are included, and maintenance and operating instruction are given.
For More Details Circle No. 103—Page 219

HOISTS and CRANES: Northern Engineering Works, 2615 Atwater St., Detroit 7—Booklet E-312 on hoists and hoist cranes contains tabulated dimension data for different capacities and spans for hoist cranes and end trucks, with typical installation views. Booklet G-700 pictures many crane installations.
For More Details Circle No. 104—Page 219

AIR VIBRATORS: SPO Inc., 6448 Grand Division Ave., Cleveland 5—Bulletin 50 gives detailed information and specifications on eight standard types of vibrators adaptable to foundry operations. Overall dimensions, weights, piston diameters and air consumption data are included in chart form.
For More Details Circle No. 105—Page 219

WORM GEAR DRIVES: Link-Belt Co., 307 North Michigan Ave., Chicago 1 — Book 2324 describes worm gear drives of three basic types, each available in ten sizes, for fractional or large horsepower, and in speed ratios of 3⅝ to 1 up to 8000 to 1.
For More Details Circle No. 106—Page 219

CONTROL SYSTEM: Lester B. Knight & Associates Inc., 600 West Jackson Blvd., Chicago 6—Brochure briefly outlines a simple, effective system to control foundry wage payments and costs.
For More Details Circle No. 107—Page 219

ELECTRIC HOIST: Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.—Illustrated bulletin H-112 presents features and specifications of the company's electric hoist. Hoist accessories also are described.
For More Details Circle No. 108—Page 219

PRODUCTS: Jeffrey Mfg. Co., 907 North Fourth St., Columbus 16, O.—Booklet 832 describes the company, its subsidiaries and the products of each.
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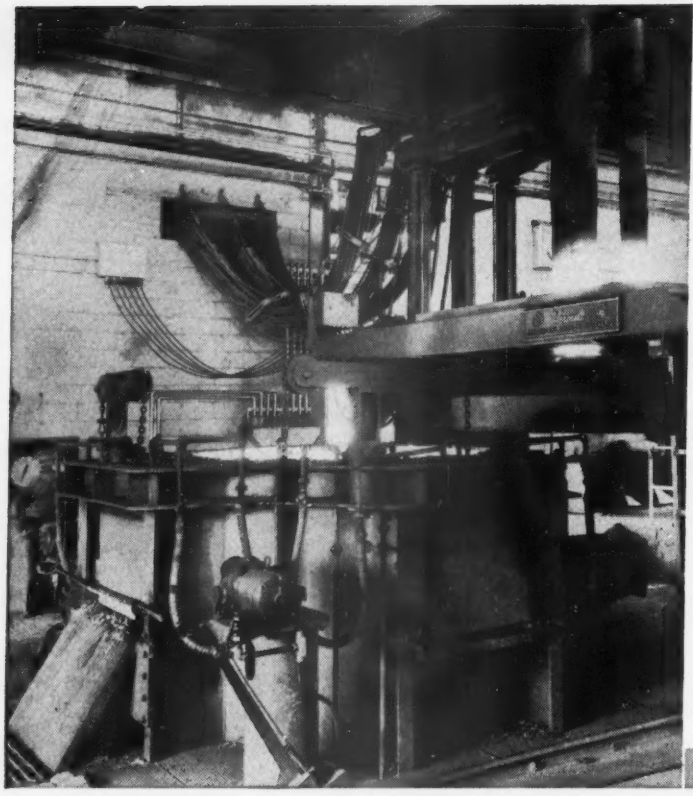

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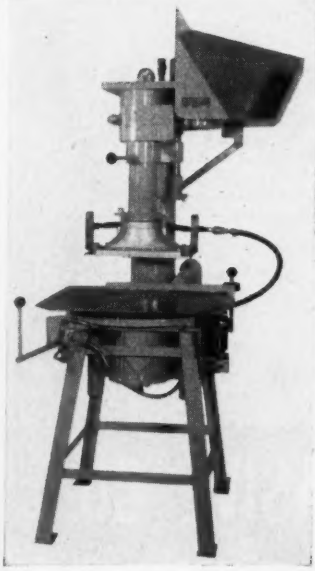

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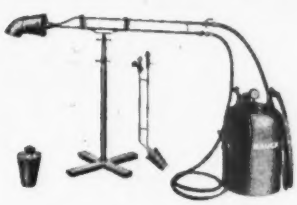

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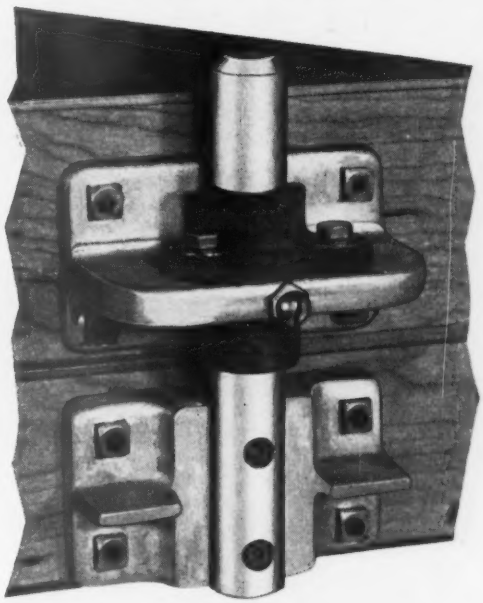

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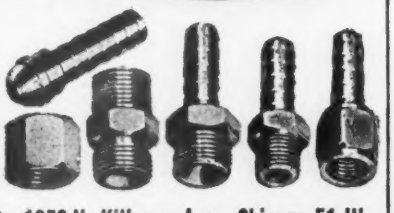
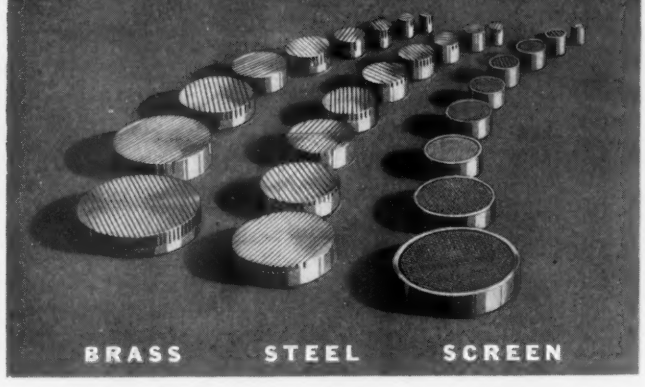


AIR-WAY PUMP & EQUIP. CO., 1058 N. Kilbourn Ave., Chicago 51 Ill.

PRECISION CORE BOX VENTS



You can depend on the quality that is built into every Demmler Core Box Vent. All orders are promptly filled from stock.

SLOTTED VENTS
(Available in Brass or Steel)
Slot Widths: .010", .013", .015"
Diameters: 1/8", 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", 5/8", 3/4", 7/8" 1", 1 1/4", 1 1/2"

STAINLESS STEEL SCREEN VENTS
Mesh: #30, #40, #50
Diameters: 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", 5/8", 3/4", 7/8", 1", 1 1/4", 1 1/2"

ILLUSTRATED FOLDER ON REQUEST

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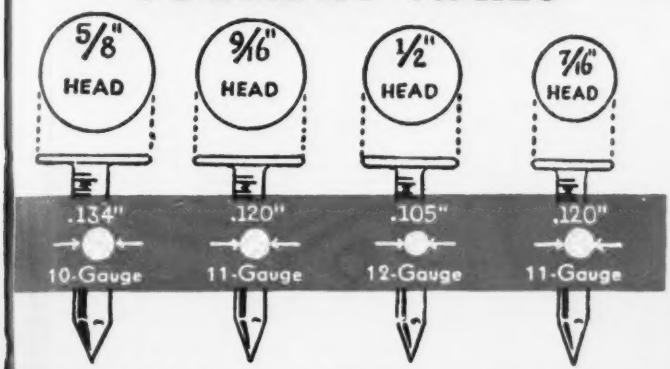
ANGELL . . . PROVEN PRESSURE PROOF CHAPLETS

Producers of SUPER HEAD FOUNDRY NAILS



⅝", 9/16" & ½" Heads available up to 3 inches in length

Standard Foundry Nails available in all lengths.

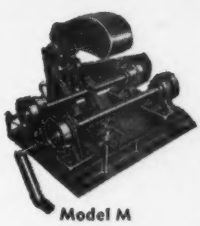
All styles of Chaplets Accurately Made for Better Castings

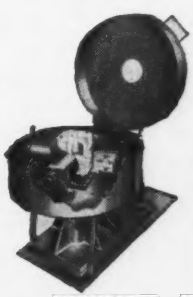
THE ANGELL NAIL & Chaplet Company
4580 East 71st Street
CLEVELAND 5, OHIO

CENTRIFUGAL CASTING MACHINES

Model AS

Model J


Model M


Model J-P

These machines used to make ferrous and non-ferrous centrifugal castings are produced by the pioneer manufacturer of such equipment.

They are made in a large variety of styles and a wide range of sizes. Complete technical information is supplied concerning sand and permanent mold design, gating, sand mixes, speeds, etc.

Send us drawings or sketches of parts you are interested in casting centrifugally, and we will tell you, without obligation, if and how our machines can cast them faster, cleaner and with fewer rejects.

CENTRIFUGAL CASTING MACHINE COMPANY
Nathan Janco, *President*
P. O. Box 947 Tulsa 1, Okla.

A BLAST FURNACE PRODUCT

Smelted from Superior quality lake ores, high grade metallurgical coke and limestone, using our own local No. 1 Sharon Seam coal.

HIGH SILICON IRON JISCO

A "blend" with JISCO is sound metallurgy.

THE JACKSON IRON & STEEL *Company*
JACKSON, OHIO

Alive today

. . . because, five years ago, he went to his doctor when he first noticed one of cancer's danger signals.

Do you know the seven common danger signals that *may* mean cancer: (1) any sore that does not heal (2) a lump or thickening, in the breast or elsewhere (3) unusual bleeding or discharge (4) any change in a wart or mole (5) persistent indigestion or difficulty in swallowing (6) persistent hoarseness or cough (7) any change in normal bowel habits.

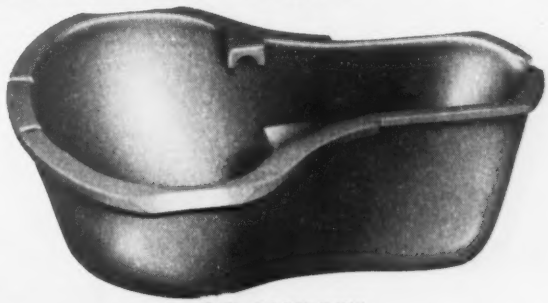
By showing Americans what they can do to protect themselves and their families against cancer, the American Cancer Society is saving thousands of lives *today*. By supporting science and medicine in the search for the causes and cures of cancer, the Society hopes to save countless more *tomorrow*. *Your* best insurance against cancer:—Make a habit of having regular periodic physical check-ups no matter how well you may *feel*. Learn the basic facts about cancer . . . Telephone the American Cancer Society office nearest you or address your letter to "Cancer" in care of your local Post Office.

American Cancer Society

MELTING POTS—Ingot Molds

FOR NONFERROUS METALS FROM ACME SPECIAL FORMULA

SPOUT POT
NO. 550A



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HOLDING BOWL
NO. HP7001

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SCHEDULE OF 40 SIZES

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Rapid Model 3/8" to 3"

RAPID and WADSWORTH
MODELS
MAKE STOCK CORES 3/8" to 7" IN ROUND, SQUARE AND IRREGULAR SHAPES . . . .

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● YOU AVOID CORE SUPPORT FAILURES BECAUSE SAND PACKS BETTER UNDER THE HEAD AND AROUND STEM.

We also make MOTOR CHAPLETS, Boiler Chaplets, Forged Head Chaplets, Fitted Head Chaplets, Double Head Chaplets and other types. ***Write for Bulletin.***

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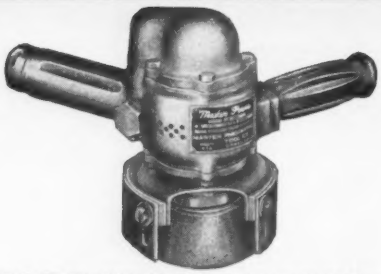
CLEVELAND *Chaplets*
Since 1890

Master Power

HARD CHROMED • PORTABLE PNEUMATIC TOOLS



DO MORE WORK AT LESS COST

because they deliver more power per cubic foot of air consumed, are light in weight for easier maneuverability and they retain their new tool power longer.

ARE PREFERRED BY OPERATORS

because they are lighter in weight, better balanced and designed to reduce shock and be free from vibration.

IF YOUR PROBLEM INCLUDES

chipping, ramming, grinding, buffing, sanding or wire brushing, *write us today for full particulars.*

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ORWELL, OHIO • U. S. A.

SALES • SERVICE • STOCK • COAST TO COAST

MIW

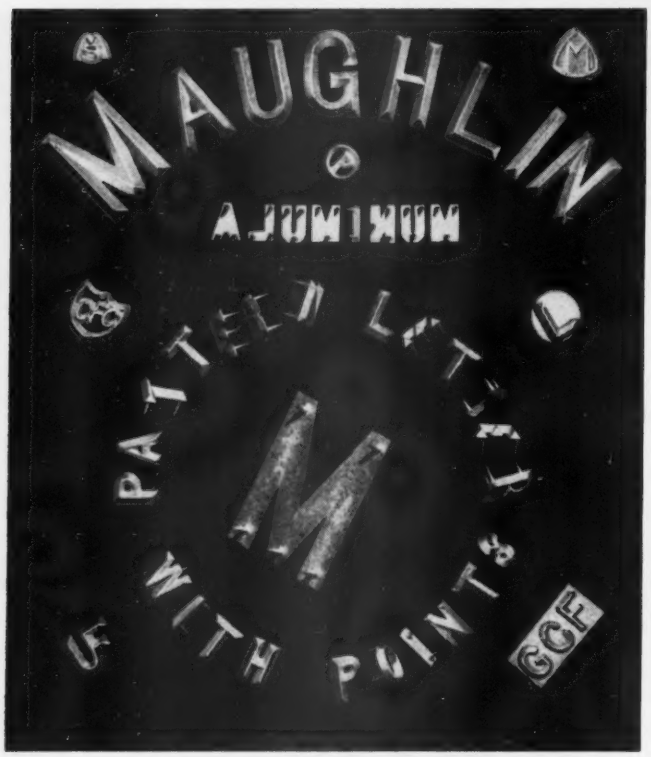
NO. 22 PORTABLE

Runs along side the sand pile. Head and table adjustable for height. Takes flasks up to 12″ by 24″. Width inside to inside of wheels 26″. Table size, 12″ by 16″. Pressure plate size, 8″ by 12″. Set-off benches included. Rust-resistant, attractive. Aluminum enamel finish.

Moline Molding Machines are available in five models. Each is designed to deliver faster production, fewer rejects, a better profit. Ask for catalog and prices.

ESTABLISHED 1878 • OVER SEVENTY YEARS OF SERVICE

A Hammer Blow Secures Letters To Pattern



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Manufacturers of letters and numbers exclusively for over 30 years

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Our technical Foundry men, qualified by years of experience in this field, will survey your present facilities and advise you on methods for lowering costs and increasing production.

Ferguson's recommendation may include a new plant, or more efficient use of existing facilities. It may mean improved methods or modern machinery; it could result in higher production without costly investments in space, equipment or personnel.

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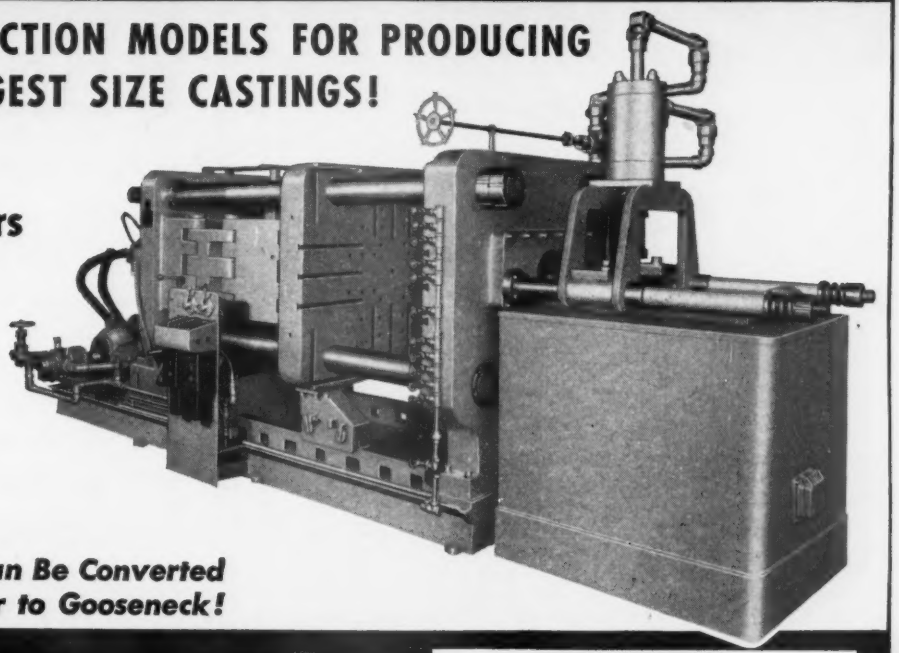
HIGH SPEED PRODUCTION MODELS FOR PRODUCING SMALL TO THE LARGEST SIZE CASTINGS!

Precision Built by Die Casting Engineers

● Cast-Master Die Casting Machines are designed and built by engineers with years of experience in the Die Casting Industry. Each model has been given months of actual operation under the most severe conditions.



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MOLDS ARE BLACKENED FASTER
CASTINGS PEEL BETTER
WORK COMES CLEANER
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PRICES COMPLETE WITH SUCTION HOSE AND SINKER

PIPE SIZE	1/16"	1/8"	1/4"	3/8"	1/2"
PRICE F. O. B. HAMILTON, O.	$12.00	$12.00	$12.00	$14.50	$18.00

Used for Silica wash, oil, water or any liquid material. For sand-blast cleaning. As a blow gun for cleaning motors and machinery. If your dealer cannot supply you at once, order direct from manufacturer below. Literature on request.

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MIX
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CUPOLA PATCH MIXES
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THEN *DISCHARGE 'EM* IN THIRTY SECONDS

Lower Costs? YOU BET!

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COLOR YOUR CORE SANDS

Modern foundries have found it practical to color their various grades of core sands. This eliminates guesswork and assures the proper use of the required type of core sand for the particular job at hand.

Our laboratories have developed a line of special dyes in a range of colors that have been carefully tested and found suitable as well as economical.

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SPECIAL TYPE *for* FOUNDRY SERVICE

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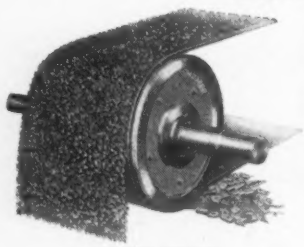
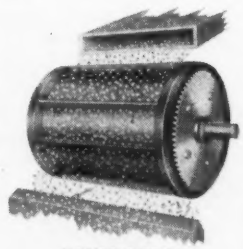
HOMER "POWER-PLUS" MAGNETIC SEPARATORS

PERMANENT non-electric — UNAFFECTED BY HEAT, COLD OR MOISTURE
CAN BE USED INSIDE OR OUTSIDE PLANT



HOMER PULLEY

Homer Permanent non-electric Magnetic Separators are the answer to LOW COST—EFFICIENT REMOVAL OF IRON from molding sand. These units are built in four different types for foundry uses: (1) The Homer Magnetic Pulley (2) The Homer Magnetic Drum (3) The Homer Magnetic Pulley Unit (4) The Homer Magnetic Plate Type. Pulleys and Pulley Units are furnished with pulley diameters from 12" to 30", belt widths from 4" to 60". Drums are available in diameters from 12" to 30", face widths from 4" to 60". Plate Types available in standard sizes from 4" to 26" widths, lengths as desired.



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Sealer and Impregnator for All Types and All Sizes of CASTINGS

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Only ROURA Has the Exclusive Instant Release (Patent Pending) Handle

Handling wet or dry, hot or cold, bulky materials quickly and easily, the ROURA is simple to operate—only one man is required for distributing and unloading—and he does this in *much* less time than ordinarily required under old-fashioned manual methods. Thousands of Roura Hoppers (which fit any standard fork or platform lift truck) are in constant daily operation, serving and saving for such firms as Ford, Champion Porcelain, General Electric, National Carbon, International Harvester, etc.

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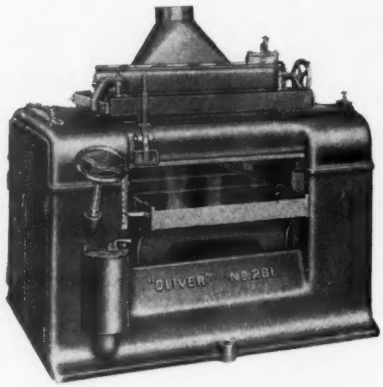
"OLIVER" Single Surfacer



Helps your pattern makers turn out better patterns . . . at less cost

Takes stock up to 30" wide, 8" thick. One-piece base assures permanent, accurate alignment of parts. One-piece upper housing. Feed mechanism enclosed for safety and longer life. Enclosed worm gear drive for feed rolls. All revolving parts mounted on ball bearings. Unique chipbreaker. Hand brake brings cylinder to quick stop. Write for Bulletin No. 261.

"Oliver" makes a full line of Surfacers, Jointers and other woodworking machinery for pattern shops

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THE MARK OF QUALITY INGOT!
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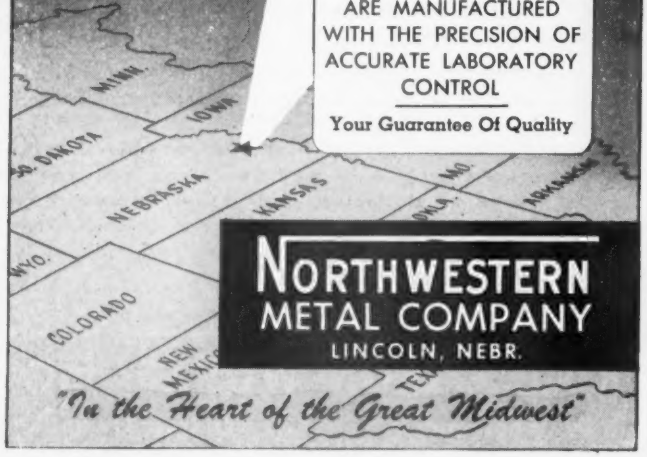
ALUMINUM
INGOTS BEARING THIS BRAND ARE MANUFACTURED WITH THE PRECISION OF ACCURATE LABORATORY CONTROL
Your Guarantee Of Quality



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LINCOLN, NEBR.
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WESTOVER ENGINEERS
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FOUNDRY MANAGEMENT CONSULTANTS
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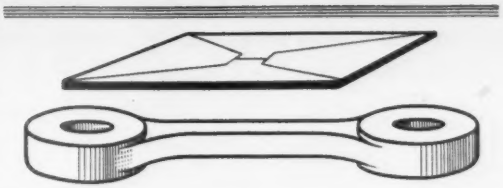
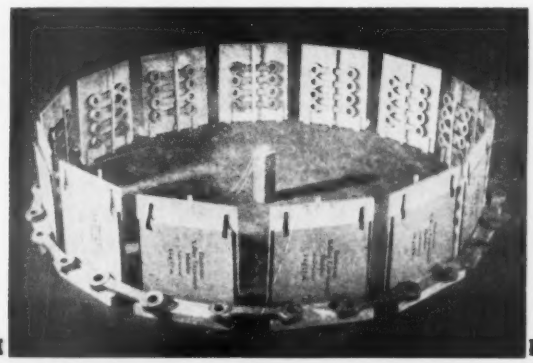


and there you have a method whereby you can increase your foundry production and improve your practice!

RADIUM RADIOGRAPHY

is new, compared with X-ray radiography, but its peculiar advantages have been finding increasing favor with steel foundries. The first commercial radiograph with radium was made in 1930—an exposure of the sternpost of the cruiser "Chester"—and by 1948 200 steel foundries throughout the country were using radium radiography. The equipment is absurdly simple, and, since it may be rented or leased, no capital expenditure is necessary. No special training is required to operate it, either. The constant activity of radium, the even dispersion of its rays with a minimum of scattering; the portability of the equipment and simplicity of operation all combine to make radium radiography a sound commercial proposition for manufacturers of steel castings. Write today for case histories and additional information.

Illustration shows 60 steel castings being photographed simultaneously. The gamma rays, flying in all directions, go through all the castings at once, making 60 exposures of the 60 castings.



RADIUM CHEMICAL CO., INC.

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A BETTER COAT FOR PATTERNS

CO-LOIDAL-AC is a one-coat lacquer that dries fast. Saves time—no settling, no stirring, no sticking. And long wearing—the finish lasts indefinitely.

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AMERICAN LACQUER SOLVENTS CO.
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EDWIN S. CARMAN, INC.

LEE ROAD AT MAYFIELD
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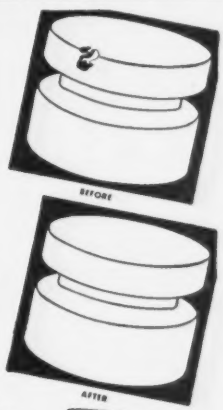
A COMPLETE FOUNDRY SERVICE

ENGINEERS

For Surface Blemishes in ALUMINUM CASTINGS



Have you used the Smooth-On Foundry Cement made especially to correct blow holes, porous and rough spots, dents and other unsightly but harmless surface defects in otherwise sound *aluminum* alloy castings?

Applied like the widely used Smooth-On *Iron* Foundry Cement, Smooth-On No. 8 *Aluminum* Cement fills in evenly, hardens quickly, matches perfectly. Stays in place, too, for it expands slightly as it sets.

Smooth-On No. 8 Aluminum Cement comes in 1- and 5-lb. sizes. 1 lb. will fill 17 cu. in. Order it by NAME AND NUMBER from your supply house. If they haven't it, write us. If you have not yet discovered Smooth-On No. 8, ask us for

FREE SAMPLE TO TEST

You'll receive also the famous 40-page SMOOTH-ON HANDBOOK filled with industrial uses for the various Smooth-On Cements. 170 illustrations. Write today.

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Do it with **SMOOTH-ON**
No. 8 ALUMINUM CEMENT

ALL GRADES OF WASHED, DRIED, SCREENED
SILICA FOUNDRY SANDS
Produced from the celebrated Ottawa District St. Peter Sandstone
Steel Molding Sand · Core Sand · Blast Sand · Furnace Bottom Sand
Opener Sand · Sand for Non-Ferrous, Aluminum, Magnesium Castings
Sands for Croning "shell" process, and for precision castings.
MICROSIL Ground Silica (5 Standard Grades of pure white Silica Flour)

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TESTING FOR CRACKS!!
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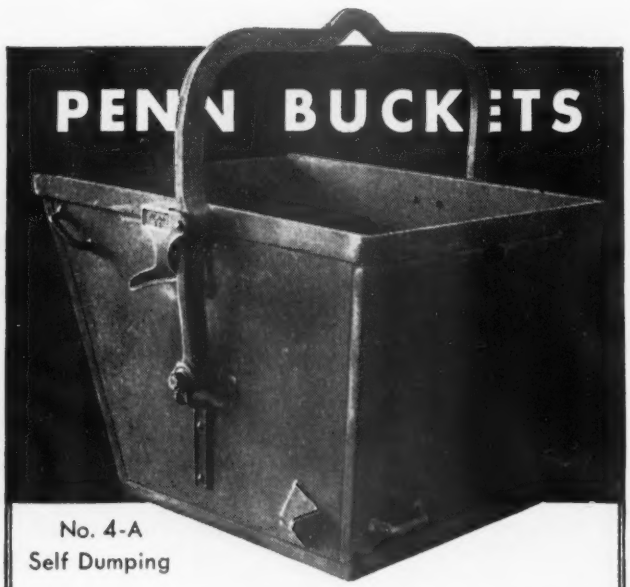
DeBardeleben Preparation and Service Give Added Value

PENN BUCKETS



No. 4-A
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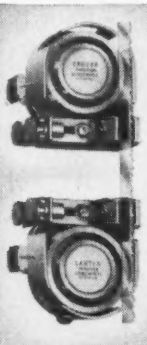

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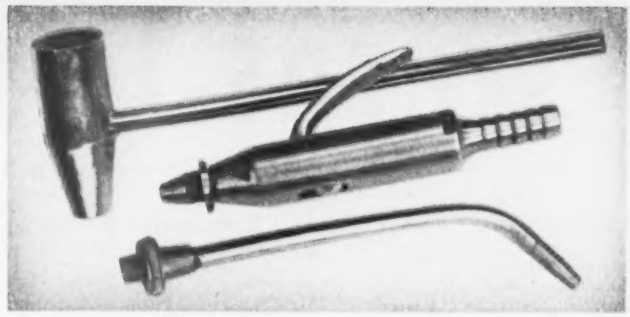

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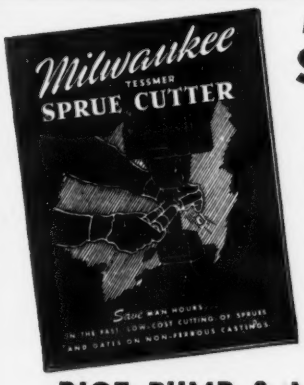

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CLAY (Refractory)

Carpenter Brothers, Inc., 606 West Wisconsin 3, Mo.
Eastern Clay Products Inc., Jackson, O.
Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.
Illinois Clay Products Co., Joliet, Ill.

CLAY STORAGE BINS

Neff & Fry, Camden, O.

CLEANING COMPOUNDS

Pelron Corp., 7740 West 47th St., Lyons, Illinois

CLEANING EQUIPMENT (Castings)

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Arrow Tools Inc., 1900 S. Kostner, Chicago, Ill.
Pangborn Corp., Hagerstown, Md.

CLUTCHES (Magnetic)

Dings Magnetic Separator Co., 4740 Electric Ave., Milwaukee 7, Wis.
Stearns Magnetic Mfg. Co., 622 S. 28th St., Milwaukee 4, Wis.

COAL STORAGE BINS

Neff & Fry, Camden, O.

COBALT (Radio Active)

Eldorado Mining & Refining Ltd., P. O. Box 379, Ottawa, Ont.

COKE (Foundry)

DeBardeleben Coal Corp., 2201 First Ave., N., Birmingham 3, Ala.
Hickman-Williams & Co., Union Commerce Bldg., Cleveland 14, O.

COKE (Foundry) (Cont'd.)

Pickands, Mather & Co., Cleveland 14, O.
Republic Coal & Coke Co., 8 So. Michigan Ave., Chicago 3, Ill.
Semet Solvay Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.
Tennessee Products & Chemical Corp., American National Bank Bldg., Nashville 3, Tenn.

COKE (Petroleum)

Republic Coal and Coke Co., 8 S. Michigan Ave., Chicago 3, Ill.

COLLECTORS (Dust)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
American Air Filter Co., 266 Central Ave., Louisville 8, Ky.
Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland, O.
Kirk & Blum Mfg. Co., Cincinnati 25, O.
Pangborn Corp., Hagerstown, Md.
Schmieg Industries, 302 Piquette, Detroit 2, Mich.
Schneible Co., Claude B., 2827 25th St., Detroit 16, Mich.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

CONCRETE STORAGE BINS

Neff & Fry Co., Camden, O.

CONTROL SYSTEMS (Dust)

American Air Filter Co., 223 Central Ave., Louisville, Ky.
American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Schmieg Industries, 302 Piquette, Detroit 2, Mich.
Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

CONVERTER BLOWERS

Roots-Connersville Blower Corp., Connersville, Ind.

CONVERTERS (Bessemer)

Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

CONVEYOR DESIGN

Giffels & Valet, Inc., Marquette Bldg., Detroit, Mich.

CONVEYORS (Apron)

Logan Co., 580 Cabel, Louisville, Ky.

CONVEYORS (Belt)

Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The 2424 No. Cicero, Chicago 39, Ill.
Boston Woven Hose & Rubber Co., 29 Hampshire, Cambridge 39, Mass.
Imperial Belting Co., 1800 So. Kilbourn Ave., Chicago 23, Ill.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Joy Mfg. Co., Joy Division, Pittsburgh, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Logan Co., 580 Cabel, Louisville, Ky.
Mathews Conveyer Co., Ellwood City, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.
Standard Conveyor Co., North St. Paul 9, Minn.

CONVEYORS (Chain)

Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Joy Mfg. Co., Joy Division, Pittsburgh, Pa.

CONVEYORS (Chain) (Cont'd.)

Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Logan Co., 580 Cabel, Louisville, Ky.
Mathews Conveyer Co., 104 Tenth St., Ellwood City, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Standard Conveyor Co., North St. Paul 9, Minn.

CONVEYORS (Gravity)

Logan Co., 580 Cabel, Louisville, Ky.
Mathews Conveyer Co., 104 Tenth St., Ellwood City, Pa.
Standard Conveyor Co., North St. Paul 9, Minn.

CONVEYORS (Live Roller)

Logan Co., 580 Cabel, Louisville, Ky.
Mathews Conveyer Co., Ellwood City, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Standard Conveyor Co., North St. Paul 9, Minn.

CONVEYORS (Magnetic)

Stearns Magnetic Mfg. Co. 662 S. 28th St., Milwaukee 4, Wis.

CONVEYORS (Monorail)

American Monorail Co., 13104 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 E. 283rd St., Wickliffe, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Mathews Conveyer Co., 104 Tenth St., Ellwood City, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Penn Iron Works, Reading, Pa.

CONVEYORS (Overhead)

Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Mathews Conveyer Co., Ellwood City, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

CONVEYORS (Pneumatic)

Fuller Company, Catasauqua, Pa.

CONVEYORS (Portable)

Joy Mfg. Co., Joy Division, Pittsburgh, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

CONVEYORS (Portable-Gas Electric)

Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

CONVEYORS (Rubber)

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Standard Conveyor Co., North St. Paul 9, Minn.

CONVEYORS (Vibrating)

Ajax Flexible Coupling Co., Westfield, N. Y.
Jeffrey Mfg. Co., 907 N. Fourth St., Ciumbus 16, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.
Simplicity Engineering Co., Durand, Mich.
Syntron Company, Homer City, Pa.

COPPER

Federal Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

COPPER SHOT

Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.
Niagara Falls Smelting & Refining Div., Continental-United Industries Co., Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.

CORE BINDERS

American Gum Products Co., 500 Fifth Ave., New York 18, N. Y.
Archer-Daniels-Midland Co., Werner G. Smith Div., 2191 W. 110th St., Cleveland 2, O.
Bakelite Corp., 300 Madison Ave. New York 17, N. Y.
Cities Service Oil Co., 3200 S. Western Ave., Chicago 8, Ill.
Corn Products Sales Co., 17 Battery Pl., New York 4, N. Y.
Delta Oil Products Co., Milwaukee 9, Wis.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
General Electric Co., Pittsfield, Mass.
Hercules Powder Co., Wilmington 99, Del.
E. F. Houghton Co. 303 W. Lehigh Ave., Philadelphia 33, Pa.
Chas. A. Krause Milling Co., 404 E. State St., Milwaukee 1, Wis.
Monsanto Chemical Co., Plastic Division, Springfield 2, Mass.
Pelron Corp., 7740 West 47th St., Lyons, Illinois
Robeson Process Co., 500 Fifth Ave., New York 18, N. Y.
Frederic B. Stevens, Inc., Detroit 16, Mich.
United Oil Mfg. Co., 1429 Walnut St., Erie, Pa.
Werner G. Smith, Inc. Union Commerce Bldg., Cleveland 14, Ohio.

CORE BLOWER BUSHINGS

Eastern Clay Products, Inc. Jackson, Ohio.
Martin Engineering Co., Kewanee, Ill.

CORE BLOWING MACHINES

Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Wm. Demmler & Bros., Kewanee, Ill.
Federal Foundry Suppy Co., 4600 E. 71st St., Cleveland 5, O.
Harrison Machine Co., Wesleyville, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Redford Iron & Equipment Co., 20733 Glendale Ave., Detroit 23, Mich.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

CORE BOXES

Accurate Match Plate Co., 1847 W. Caroll St., Chicago, Ill.

CORE COLORING

Eaton Chemical & Dyestuff Co. 1490 Franklin, Detroit, Mich

CORE COMPOUND

Archer-Daniels-Midland Co., Werner G. Smith Div., 2191 W. 110th St., Cleveland 2, O.
Bakelite Corp., 300 Madison Ave., New York 17, N. Y.
Cities Service Oil Co., 3200 S. Western Ave., Chicago 8, Ill.
Delta Oil Products Co., Milwaukee 9, Wis.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Pelron Corp., 7740 West 47th St., Lyons, Illinois
Frederic B. Stevens, Inc., Detroit 16, Mich.
Werner G. Smith, Inc., Union Commerce Bldg., Cleveland 14, O.

CORE DRAWER

Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.

CORE DRAWING MACHINES

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Freeman Supply Co., Toledo 5, O.
Newaygo Engineering Co., Newaygo, Mich.

CORE DRIERS (Dielectric)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

CORE FLUXES (Aluminum, Magnesium)

Pelron Corp., 7740 West 47th St., Lyons, Illinois

CORE GRINDERS (Power Operated)

Jeffrey Mfg. Co., Columbus 16, O.
Milwaukee Foundry Equipment Div., Spo Inc., 3328 Pierce St., Milwaukee 4, Wis.
Standard Pattern Works, 6771 E. McNichols, Detroit 12, Mich.
Sutter Products Co., Dearborn, Mich.

CORE KNOCKOUT MACHINES

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Pangborn Corp., Hagerstown, Md.
Simplicity Engineering Co., Durand, Mich.

CORE MAKING MACHINES

Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Wm. Demmler & Bros., Kewanee, Ill.
Federal Foundry Suppy Co., 4600 E. 71st St., Cleveland 5, O.
Harrison Machine Co., Wesleyville, Pa.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Milwaukee Foundry Equipment Div., Spo Inc., 3328 Pierce St., Milwaukee 4, Wis.
Redford Iron & Equipment Co., 20733 Glendale Ave., Detroit 23, Mich.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
Wadsworth Equipment Co., 560 Lafollette St., Akron, Ohio.

CORE OILS

Archer-Daniels-Midland Co., Werner G. Smith Div., 2191 W. 110th St., Cleveland 2, O.
Cities Service Oil Co., 3200 S. Western Ave., Chicago 8, Ill.
Delta Oil Products Co., Milwaukee 9, Wis.
E. F. Houghton Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Pelron Corp., 7740 West 47th St., Lyons, Illinois
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
Frederic B. Stevens, Inc., Detroit 26, Mich.
United Oil Mfg. Co., 1429 Walnut St., Erie, Pa.
Werner G. Smith, Inc., Union Commerce Bldg., Cleveland 14, Ohio.

CORE OVENS

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, O.
Despatch Oven Co., Minneapolis 14, Minn.
Drying Systems, Inc., 1801 Foster Ave., Chicago 40, Ill.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, O.
Girdler Corp., Thermex Division, 224 E. Broadway, Louisville 2, Ky.
Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Mich.
Kirk & Blum Mfg. Co., Cincinnati 25, O.
Lanly Company, 750 Prospect Ave., Cleveland 15, O.
Porbeck Mfg. Co., 2600 N. 9th St., St. Louis 6, Mo.
Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.

CORE PASTE

Corn Products Sales Co., 17 Battery Pl., New York 4, N. Y.
Delta Oil Products Co., Milwaukee 9, Wis.
Eastern Clay Products Co., Jackson, O.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

CORE PASTE (Cont'd.)

Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.

CORE PLATES (Steel, Asbestos)

Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
Johns-Manville, 22 E. 40th St., New York 16, N. Y.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.

CORE ROD STRAIGHTENING and CUTTING MACHINERY

American Wheelabrator & Equipment Co., Mishawaka, Ind.

CORE SAND

American Silica Sand Co., Central Life Bldg., Ottawa, Ill.
Ottawa Silica Co., Ottawa, Ill.
Standard Silica Corp., 209 So. LaSalle St., Chicago 4, Ill.
Titanium Alloy Mfg. Div., National Lead Co., Hyde Park Blvd., Niagara Falls, N. Y.
Weldron Silica Co., 38 So. Dearborn St., Chicago, Ill.

CORE SAND MIXERS

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Baker Perkins Inc., Saginaw, Mich.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Clearfield Machine Co., Clearfield, Pa.
Federal Foundry Supply Co., 4600 E.71st St., Cleveland 5, Ohio.
Multiplex Machinery Corp., Elmore, Ohio.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Posey Iron Works Inc., Lancaster, Pa.
Royer Foundry & Machine Co., Kingston, Pa.

CORE SPRAYERS

Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.

CORE STRIPPERS

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

CORE TRAYS

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.

CORE TRUCKS

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Clark Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.
Kirk & Blum Mfg. Co., Cincinnati 25, O.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

CORE VENTS

Demmler, Wm., & Bros., Kewanee, Ill.
Smillie, C. M. & Co., 1124 Woodward Heights Blvd., Ferndale 20, Mich.
United Compound Co., Inc., 328 South Park Ave., Buffalo 4, N. Y.

CORE WASH

Asbury Graphite Mills, Asbury, N. J
Bloomsbury Graphite Co., Bloomsbury, N. J.
Carborundum Co., Perth Amboy, N. J.

CORE WASH (Cont'd.)

Cities Service Oil Co., 3200 S. Western Ave., Chicago 8, Ill.
Corn Products Sales Co., 17 Battery Pl., New York City 4.
Delta Oil Products Co., Milwaukee 9, Wis.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
E. F. Houghton Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
National Carbon Co., Inc., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
Stevens, Frederic B., Inc., Detroit 26, Mich.
Titanium Alloy Mfg. Div., National Lead Co., Hyde Park Blvd., Niagara Falls, N. Y.
United Oil Mfg. Co., 1429 Walnut St., Erie, Pa.
United States Graphite Co., Saginaw, Mich.

CORE WIRE CUTTERS

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

CORE WIRE STRAIGHTENERS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

CORE WIRES

Crescent Brass & Pin Co., 5766 Trumbull Ave., Detroit, Mich.

CORES (Annealing)

Pressed Steel Co., Wilkes-Barre, Pa.

COUPLINGS (Air Line)

Cleco Division of Reed Roller Bit Co., Houston, Tex.

COUPLINGS (Flexible)

Ajax Flexible Coupling Co., Westfield, N. Y.

CRANE LUBRICATING SYSTEMS

Blaw-Knox Co., Farmers Bank Bldg., Pittsburgh, Pa.

CRANES (Bucket)

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Electric Tramrail)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.

CRANES (Electric Traveling)

American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Erie Steel Construction Co., Erie, Pa.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Shepard-Niles Crane & Hoist Corp., 360 Schuyler Ave., Montour Falls, N. Y.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Gantry)

Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Modern Equipment Co., Port Washington, Wis.
Wellman Engineering Co., 7000 Central Ave., Cleveland 4, O.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Hand Traveling)

American MonoRail Co., 13104 Athens Ave., Cleveland 7, Ohio.
Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.

CRANES (Hand Traveling) (Cont'd.)

Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Modern Equipment Co., Port Washington, Wis.
Shepard-Niles Crane & Hoist Corp., Montour Falls, N. Y.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Jib)

American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.
Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Modern Equipment Co., Port Washington, Wis.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Monorail)

American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.
Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Modern Equipment Co., Port Washington, Wis.
Shepard-Niles Crane & Hoist Corp., 360 Schuyler Ave., Montour Falls, N. Y.

CRANES (Self-Propelled)

Silent Hoist & Crane Co., 835 63rd St., Brooklyn 20, N. Y.

CRANES (Traction or Tractor)

Silent Hoist & Crane Co., 835 63rd St., Brooklyn 20, N. Y.

CRUCIBLES

American Crucible Co., North Haven, Conn.
Bay State Crucible Co., Taunton, Mass.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Lava Crucible Co., Pittsburgh, Pa.
Ross-Tacony Crucible Co., Tacony, Philadelphia, Pa.
Vesuvius Crucible Co., Swissvale, Pa.

CRUCIBLE FURNACES

Ajax Electrothermic Corp., Trenton, N. J.
Campbell-Hausfeld Co., Harrison, O.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.

CRUCIBLE LIFTERS

Modern Equipment Co., Port Washington, Wis.

CRUCIBLE POURING DEVICES

Modern Equipment Co., Port Washington, Wis.

CRUSHERS (Core)

Simplicity Engineering Co., Durand, Mich.

CUPOLAS

Modern Equipment Co., Port Washington, Wis.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CUPOLA BLOWERS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Roots-Connersville Blower Corp., Connersville, Ind.
Spencer Turbine Co., Hartford, Conn.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CUPOLA CHARGING MACHINES

American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Modern Equipment Co., Port Washington, Wis.
Shepard-Niles Crane & Hoist Corp., Montour Falls, N. Y.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CUPOLA CONTROL EQUIPMENT

Edwin S. Carman, 1643 Lee Road, Cleveland 18, Ohio.
Foxboro Company, Foxboro, Mass.

CUPOLA DUST ARRESTORS

Schneible Co., Claude B., 2827—25th St., Detroit 16, Mich.

CUPOLA LININGS

Carborundum Co., Perth Amboy, N. J.
Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.
A. P. Green Fire Brick Co., Mexico, Missouri.
Ironton Fire Brick Co., Ironton, O.
United States Graphite Co., Saginaw, Mich.

CUPOLA PATCHING GUNS

Eastern Clay Products, Inc., Jackson, Ohio.

CUPOLA SPARK ARRESTORS

Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CUTOFF MACHINES (Abrasive)

Fox Grinders Inc., Oliver Bldg., Pittsburgh, Pa.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

CYLINDERS (Hydraulic)

Miller Motor Co., 4027 N. Kedzie, Chicago 18, Ill.

DARK ROOM ACCESSORIES (X-Ray)

Eastman Kodak Co., Rochester, N. Y.
General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

DARK ROOM PROCESSING (Chemical Tanks, etc.)

Eastman Kodak Co., Rochester, N. Y.

DEGASIFIERS

Metalloy Corp., Rand Tower, Minneapolis 2, Minn.
Pittsburgh Metals Purifying Co., 1352 Marvista St., Pittsburgh 12, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Niagara Falls Smelting & Refining Div., Continental-United Industries Co., Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.

DEOXIDIZERS

Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

DEOXIDIZERS (Cont'd.)

Cleveland Flux Co., 1026 Main St., Cleveland 13, O.
Metalloy Corp., Rand Tower, Minneapolis 2, Minn.
Niagara Falls Smelting & Refining Div., Continental-United Industries Co., Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.
Pittsburgh Metals Purifying Co., 1352 Marvista St., Pittsburgh 12, Pa.

DEOXIDIZERS (Ferrous)

Carborundum Co., Perth Amboy, N. J.

DESULPHURIZERS

American Silica Sand Co., Central Life Bldg., Ottawa, Ill.
Cleveland Flux Co., 1026 Main St., Cleveland 13, O.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Hercules Powder Co., Wilmington 99, Del.
Mathieson Chemical Corp., 60 Mathieson Bldg., Baltimore 3, Md.
Modern Equipment Co., Port Washington, Wis.
Pittsburgh Metals Purifying Co., 1352 Marvista St., Pittsburgh 12, Pa.
Solvay Sales Division Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

DIE CASTING MACHINES

Kux Machine Co., 3930 W. Harrison St., Chicago 24, Ill.
Lester-Phoenix Inc., 2711 Church St., Cleveland 13, Ohio.
Miller-Taylor Tool Co., 5005 Euclid Ave., Cleveland 3, Ohio.

DIES

City Pattern Foundry & Machine Co., 1161 Harper Ave., Detroit 11, Mich.
Lester-Phoenix Inc., 2711 Church St., Cleveland 13, Ohio.

DIRECT FIRED HEATERS

Dravo Corp., Neville Island, Pittsburgh 25, Pa.

DOWEL PINS

Standard Horse Nail Corp., New Brighton, Pa.

DRILLS (Electric)

Mall Tool Co., 7720 So. Chicago Ave., Chicago 19, Ill.
Standard Electrical Tool Co., 2488 River Road, Cincinnati 4, Ohio.

DRILLS (Pneumatic)

Gardner-Denver Co., Quincy, Ill.
Mall Tool Co., 7720 So. Chicago Ave., Chicago 19, Ill.
Schramm Inc., West Chester, Pa.

DRIVES (Reciprocating)

Ajax Flexible Coupling Co., Westfield, N. Y.

DRUMS (Magnetic)

Dings Magnetic Separator Co., 4740 Electric Ave., Milwaukee 7, Wis.
Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

DRYERS

Porbeck Mfg. Co., 2600 N. 9th St., St. Louis 6, Mo.

DRYING OVENS

Drying Systems, Inc., 1801 Foster Ave., Chicago 40, Ill.

DUMP HOPPERS

Roura Iron Works, 1405 Woodland Ave., Detroit 11, Mich.

DUMP TRUCKS

Frank G. Hough Co., Libertyville, Ill.
Kwik-Mix Co., Port Washington, Wis.
Prime Mover Co., Muscatine, Iowa.

DUST ARRESTING EQUIPMENT

American Air Filter Co., Inc., 266 Central Ave., Louisville 8, Ky.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, O.
Dracco Corp., 4063 East 116th St., Cleveland 5, Ohio.
Kirk & Blum Mfg. Co., Cincinnati 25, O.
Pangborn Corp., Hagerstown, Md.
Schmieg Industries, 302 Piquette, Detroit 2, Mich.
Schneible Co., Claude B., 2827—25th St., Detroit 16, Mich.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

DUST COLLECTORS

Pangborn Corp., Hagerstown, Md.
Schmieg Industries, 302 Piquette, Detroit 2, Mich.
Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.

DUST COLLECTORS (Shake-out)

Pangborn Corp., Hagerstown, Md.

DUST CONTROL (Chemical)

Dracco Corp., 4063 East 116th St., Cleveland 5, Ohio.
Pangborn Corp., Hagerstown, Md.
Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.

DUST RECOVERY SYSTEMS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Dracco Corp., 4063 East 116th St., Cleveland 5, Ohio.
Kirk & Blum Mfg. Co., Cincinnati 25, O.
Pangborn Corp., Hagerstown, Md.

DYES & CHEMICALS

Eaton Chemical & Dyestuff Co., 1490 Franklin, Detroit, Mich.

ELECTRIC FURNACES (see Furnaces, Electric)

ELECTRODES (Graphite and Amorphous)

International Graphite & Electrode Corp., St. Marys, Pa.
National Carbon Co., Inc., Electrode Sales Div., 30 E. 42nd St., New York 17, N. Y.

ELEVATORS

Standard Conveyor Co., North St. Paul 9, Minn.

ELEVATORS (Bucket)

Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, O.
Jeffrey Mfg. Co., Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Newaygo Engineering Co., Newaygo, Mich.
Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.

ELEVATORS (Material Handling)

Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

ELEVATORS (Pneumatic, Material Handling)

Fuller Co., Catasauqua, Pa.

ENGINEERING SERVICE (Foundry)

H. K. Ferguson, 1783 E. 11th St., Cleveland 14, Ohio.
Giffels & Vallet, Inc., Marquette Bldg., Detroit, Mich.

Lester B. Knight & Associates, Inc., 600 West Jackson Blvd., Chicago 3, Ill.
A. H. Putnam Co., 1319 2nd Ave. Rock Island, Ill.
Westover Engineers, 424 E. Wells St., Milwaukee 2, Wis.

EXHAUST SYSTEMS

American Air Filter Co., Inc., Louisville 8, Ky.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corporation, Hagerstown, Md.
Schmieg Industries, 302 Piquette, Detroit 2, Mich.
Schneible Co., Claude B., 2827 25th St., Detroit 16, Mich.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

FABRICATORS (Metal)

Roura Iron Works, 1405 Woodland Ave., Detroit 11, Mich.

FACINGS

Delta Oil Products Co., Milwaukee 9, Wis.
Joseph Dixon Crucible Co., Monmouth St., Jersey City, N. J.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
National Carbon Co., Inc., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.
Stevens Inc., Frederic B., Detroit 16, Mich.
United States Graphite Co., Saginaw, Mich.

FANS (Ventilating, Exhaust, Cooling, etc.)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Hartzell Propeller Fan Co., Piqua, Ohio
Joy Mfg. Co., La Del Division, New Philadelphia, Ohio.
Pangborn Corp., Hagerstown, Md

FEEDERS (Rotary)

Fuller Company, Catasauqua, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Newaygo Engineering Co., Newaygo, Mich.

FEEDERS (Sand)

Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, O.
Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

FERROBORON

Electro Metallurgical Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Molybdenum Corp. of America. Pittsburgh 19, Pa.

FERROCHROME

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St. New York 17, N. Y.
Hickman-Williams & Co., Cleveland, O.
Ohio Ferro-Alloys Corp., Canton 2, O.
Vanadium Corp., of America, 420 Lexington Ave., New York, N. Y.

FERROCOLUMBIUM

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

FERROMANGANESE

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Ohio Ferro-Alloys Corp., Canton 2, O.
Tennessee Products & Chemical Corp., American National Bank Bldg., Nashville 3, Tenn.

FERROMOLYBDENUM

Climax Molybdenum Co., 500 Fifth Ave., New York 18, N. Y.
Molybdenum Corporation of America, Pittsburgh 19, Pa.

FERROPHOSPHOROUS

Tennessee Products & Chemical Corp., American National Bank Bldg., Nashville 3, Tenn.

FERROSILICON

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Jackson Iron & Steel Co., Jackson, O.
Keokuk Electro Metals Co., 429 So. 4th St., Keokuk, Iowa.
Miller & Company, 332 S. Michigan Ave., Chicago 4, Ill.
Ohio Ferro-Alloys Corp., Canton 2, O.
Tennessee Products & Chemical Corp., American National Bank Bldg., Nashville 3, Tenn.
Vanadium Corp. of America, 420 Lexington Ave., New York, N. Y.

FERROTITANIUM

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Titanium Alloy Mfg. Div., National Lead Co., Hyde Park Blvd., Niagara Falls, N. Y.
Vanadium Corp. of America, 420 Lexington Ave., New York, N. Y.

FERROTUNGSTEN

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Molybdenum Corp. of America, Pittsburgh 19, Pa.

FERROVANADIUM

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Vanadium Corp. of America, 420 Lexington Ave., New York, N. Y.

FILLET (Leather)

Milwaukee Leather Belting Co., 1114 No. Water St., Milwaukee, Wis.

FILM (X-Ray)

Eastman Kodak Co., Rochester, N. Y.
General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

FILTERS (Air)

American Air Filter Co., 266 Central Ave., Louisville 8, Ky.
Dollinger Corp., 36 Centre Park, Rochester 4, N. Y.

FILTERS (Liquid)

Dollinger Corp., 36 Centre Park, Rochester 4, N. Y.

FIRE BRICK

Babcock & Wilcox Co., 85 Liberty St., New York 6, N. Y.

FIRE BRICK (Cont'd.)

Carborundum Co., Perth Amboy, N. J.
Electro Refractories & Alloys Corp., Vars Building, Buffalo 2, N. Y.
A. P. Green Fire Brick Co., Mexico, Missouri.
Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.
Illinois Clay Products Co., Joliet, Ill.
Mexico Refractories Co., Mexico, Mo.
Norton Co., Worcester 6, Mass.
Stevens Inc., Frederic B., Detroit 16, Mich.

FIRE CLAY

Eastern Clay Products, Inc., Jackson, O.
A. P. Green Fire Brick Co., Mexico, Missouri.
Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.
Illinois Clay Products Co., Joliet, Ill.
Ironton Fire Brick Co., Ironton, O.

FIRE SAND

Carborundum Co., Niagara Falls, N. Y.
Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.

FIRESTONE

Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.

FLASK BANDS

Chicago Mfg. & Distributing Co., 1928 W. 16th St., Chicago 9, Ill.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

FLASK BUSHINGS

Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Universal Engineering Co., Frankenmuth, Mich.

FLASK PINS

Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Universal Engineering Co., Frankenmuth, Mich.
V-G Flask & Fitting Co., Clinton, Conn.

FLASKS (Aluminum)

Adams Co., Dubuque, Iowa.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, O.

FLASKS (Dowmetal)

Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, O.

FLASK FILLERS

Bartlett & Snow, C., C., Co., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Jeffrey Mfg. Co., Columbus 16, O.

FLASKS (Slip)

Adams Co., Dubuque, Iowa.
Diamond Clamp & Flask Co., Richmond, Ind.
Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, O.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.

FLASKS (Snap)

Adams Co., Dubuque, Iowa.
Diamond Clamp & Flask Co., Richmond, Ind.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Stevens, Inc., Frederic B., Detroit 16, Mich.
V-G Flask & Fitting Co., Clinton, Conn.

FLASKS (Steel)

Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.

FLASK FITTINGS

Adams Co., Dubuque, Iowa.
Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.
Diamond Clamp & Flask Co., Richmond, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.
V-G Flask & Fitting Co., Clinton, Conn.

FLASK LIFT MACHINES

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

FLASK LUMBER

Dougherty Lumber Co., 4300 E. 66th St., Cleveland 5, O.

FLASKS (Wood)

Adams Co., Dubuque, Iowa.
Chicago Mfg. & Distributing Co., 1928 W. 16th St., Chicago 9, Ill.
Diamond Clamp & Flask Co., Richmond, Ind.
V-G Flask & Fitting Co., Clinton, Conn.

FLOORING (Non-Slip)

Norton Co., Worcester 6, Mass.

FLUXES

American-British Chemical Supplies Inc., 180 Madison Ave., New York 16, N. Y.
Apex Smelting Co., 2537 West Taylor St., Chicago 12, Ill.
Atlantic Chemical & Metals Co., 1925 N. Kenmore, Chicago 14, Ill.
Cleveland Flux Co., 1026 Main St., Cleveland 13, O.
Mathieson Chemical Corp., Mathieson Bldg., Baltimore 3, Md.

FLUXES (Cont'd.)

Niagara Falls Smelting & Refining Div., Continental-United Industries Co., Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.
Pittsburgh Metals Purifying Co., 1352 Marvista St., Pittsburgh 12, Pa.
Puro-Seal Co., 2323 West Third, Cleveland 13, Ohio.

FLUXES (Soldering, Welding & Tinning)

Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

FOUNDRY CONSULTANTS

Lester B. Knight & Associates Inc., 600 West Jackson Blvd., Chicago 3, Ill.

FOUNDRY ENGINEERS

Edwin S. Carman, 1643 Lee Road, Cleveland 18, Ohio.
Lester B. Knight & Associates Inc., 600 West Jackson Blvd., Chicago 3, Ill.
A. A. Wickland Co., 205 W. Wacker Dr., Chicago 6, Ill.

FOUNDRY LAYOUT & METHODS

H. K. Ferguson, 1783 E. 11th St., Cleveland 14, Ohio.
Giffels & Vallet, Inc., Marquette Bldg., Detroit, Mich.
Lester B. Knight & Associates, Inc., 600 West Jackson Blvd., Chicago 3, Ill.

FOUNDRY NAILS

Crescent Brass & Pin Co., 5766 Trumbull Ave., Detroit, Mich.
Standard Horse Nail Corp., New Brighton, Pa.

FOUNDRY SHOVELS
(See SHOVELS)

FOUNDRY SUPPLY HOUSES

Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo 7, N. Y.
Eastern Clay Products, Inc., Jackson, O.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O
Stevens, Inc., Frederic B., Detroit 16, Mich.

FULLER'S EARTH

Olmsted Clay Co., Cairo, Ill.

FURNACES (Aluminum & Magnesium Billets)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

FURNACES (Aluminum & Magnesium Forgings)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

FURNACES (Aluminum Melting)

Ajax Engineering Corp., Trenton, N. J.
Campbell-Hausfeld Co., Harrison, O.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.

FURNACES (Aluminum Rivet Heating)

Ajax Electric Co., Inc., Philadelphia 23, Pa.

FURNACES (Annealing)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Mich.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.

FURNACES (Crucible Melting)

Ajax Electrothermic Corp., Trenton, N. J.
Campbell-Hausfeld Co., 300-320 Moore St., Harrison, O.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.

FURNACES (Electric Melting)

Ajax Electric Furnace Corp., 46 Richmond St., Philadelphia 23, Pa.
Ajax Electrothermic Corp., Trenton, N. J.
Ajax Engineering Corp., Trenton, N. J.
American Bridge Co., Pittsburgh 19, Pa.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Greene Electric Furnace Co., 2702 6th So., Seattle 4, Wash.
Pittsburgh Lectromelt Furnace Corp., P.O. Box 1125, Pittsburgh, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Gas or Oil Fired)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Campbell-Hausfeld Co., Harrison, O.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lanly Company, 750 Prospect Ave., Cleveland 15, Ohio.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.

FURNACES (Gray Iron Melting)

American Bridge Co., Pittsburgh 19, Pa.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Pittsburgh Lectromelt Furnace Corp., P.O. Box 1125, Pittsburgh, Pa.

FURNACES (Heat Treating)

Ajax Electric Co., Inc., Philadelphia 23, Pa.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Mich.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.

FURNACES, HEAT TREATING (Electric)

Ajax Electric Co., Inc., Philadelphia 23, Pa.
Ajax Electrothermic Corp., Trenton, N. J.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

FURNACES (Induction Heating)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

FURNACES (Malleable Annealing)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
General Electric Co., Schenectady, N. Y.
Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Mich.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Malleable Melting)

American Bridge Co., Pittsburgh 19, Pa.
Pittsburgh Lectromelt Furnace Corp., P.O. Box 1125, Pittsburgh, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Nonferrous Melting)

Ajax Electrothermic Corp., Trenton, N. J.
Ajax Engineering Corp., Trenton, N. J.
Campbell-Hausfeld Co., Harrison, O.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.

FURNACES (Powdered Coal)

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Steel Melting)

Ajax Electrothermic Corp., Trenton, N. J.
American Bridge Co., Pittsburgh 19, Pa.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Pittsburgh Lectromelt Furnace Corp., P.O. Box 1125, Pittsburgh, Pa.

FURNACE BLOWERS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Campbell-Hausfeld Co., Harrison, O.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Joy Mfg. Co., La-Del Division, New Philadelphia, Ohio.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Roots-Connersville Blower Corp., Connersville, Ind.

FURNACE LININGS

Campbell-Hausfeld Co., Harrison, O.
Carborundum Co., Perth Amboy, N. J.
Electro Refractories & Alloys Corp., Vars Building, Buffalo 2, N. Y.
A. P. Green Fire Brick Co., Mexico, Missouri.
Ironton Fire Brick Co., Ironton, O.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
National Carbon Co. Inc., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.
Titanium Alloy Mfg. Div., National Lead Co., Hyde Park Blvd., Niagara Falls, N. Y.
United States Graphite Co., Saginaw, Mich.

GAGGERS

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Wadsworth Equipment Co., 560 Lafollette St., Akron, Ohio.

GAS (Oxygen, Acetylene, Industrial)

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

GAS BURNERS

Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard St., Chicago 12, Ill.

GENERATORS (Acetylene)

Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

GLOVES (Industrial, Safety)

American Optical Co., Southbridge, Mass.
United States Rubber Co., 4300 New Haven Ave., Ft. Wayne 4, Ind.

GOGGLES and EYE PROTECTORS

American Optical Co., Southbridge, Mass.
Chicago Eye Shield Co., 2300 West Warren, Chicago 12, Ill.
B. F. McDonald Co., 5112 South Hoover St., Los Angeles 37, Calif.
Wilson Products Inc., Reading, Pa.

GRAPHITE

Asbury Graphite Mills, Asbury, N.J.
Acheson Colloids Corp., Port Huron, Mich.
Bloomsbury Graphite Co., Bloomsbury, N. J.
Joseph Dixon Crucible Co., Monmouth St., Jersey City, N. J.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
International Graphite & Electrode Corp., St. Marys, Pa.
National Carbon Co. Inc., Carbon Products Div., 30 E. 42nd St., New York 17.
United States Graphite Co., Saginaw, Mich.

GRAPHITIZER

United States Graphite Co., Saginaw, Mich.

GRINDERS (Electric Portable)

Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Independent Pneumatic Tool Co., Aurora, Ill.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.
Standard Electrical Tool Co., 2488 River Road, Cincinnati 4, Ohio.
U. S. Electrical Tool Co., Cincinnati 4, O.

GRINDERS (Flexible Shaft)

Mall Tool Co., 7720 So. Chicago Ave., Chicago 19, Ill.

GRINDERS (Hand)

Chicago Wheel & Mfg. Co., 1101 W. Monroe, Chicago 7, Ill.

GRINDERS (Pneumatic Portable)

Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Tex.
Independent Pneumatic Tool Co., Aurora, Ill.
Master Pneumatic Tool Co., Inc., Orwell, Ohio.
Rotor Tool Co., 17325 Euclid Ave. Cleveland 12, Ohio.

GRINDERS (Portable Electric)

Mall Tool Co., 7720 So. Chicago Ave., Chicago 19, Ill.

GRINDERS (Surface, Bench, Disc. Floor)

Bradford Machine Tool Co., 659 Evans St., Cincinnati, Ohio.
Fox Grinders, Inc., Oliver Bldg., Pittsburgh 22, Pa.
Independent Pneumatic Tool Co., Aurora, Ill.
Standard Electrical Tool Co., 2488 River Road, Cincinnati 4, Ohio.
U. S. Electrical Tool Co., 2488 River Rd., Cincinnati 4, O.

GRINDERS (Swing Frame)

Fox Grinders, Inc., Oliver Bldg., Pittsburgh 22, Pa.
Sutter Products Co., Dearborn, Mich.

GRINDING WHEELS—See ABRASIVE WHEELS

GRINDING WHEEL DRESSERS

Carborundum Co., Niagara Falls, N. Y.
Desmond-Stephans Mfg. Co., Urbana, O.

GRINDSTONES

Bay State Abrasive Products Co., Westboro, Mass.

GRIT (Abrasive)

Alloy Metal Abrasive Co., Ann Arbor, Mich.
American Steel Abrasives Co., Galion, O.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
Carborundum Co., Niagara Falls, N. Y.
Clayton Sherman Abrasives Co., 3896 Lonyo Rd., Detroit 10, Mich.
Cleveland Metal Abrasive Co., 887 E. 67th St., Cleveland, Ohio.
Globe Steel Abrasive Co., Mansfield, Ohio.
Hickman-Williams & Co., Union Commerce Bldg., Cleveland 14, O.
Metal Blast, Inc., 871 E. 67th St., Cleveland, Ohio.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh 1, Pa.

HAMMERS (Chipping)

Arrow Tools Inc., 1900 S. Kostner, Chicago, Ill.
Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas.
Dayton Pneumatic Tool Co., Dayton 1, Ohio.
Independent Pneumatic Tool Co., Aurora, Ill.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Master Pneumatic Tool Co., Inc., Orwell, Ohio.
Schramm Inc., West Chester, Pa.

HARDNESS TESTING EQUIPMENT

Detroit Testing Machine Co., 19390 Grinnell Ave., Detroit 13, Mich.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
Steel City Testing Machines Inc., 8843 Livernois Ave., Detroit 4, Mich.
Foxboro Company, Foxboro, Mass.
Claude S. Gordon Co., 3000 So. Wallace, Chicago 16, Ill.
Illinois Testing Laboratories, Inc., 418 N. LaSalle St., Chicago 10, Ill.

HEAT CONTROL AND RECORDING DEVICES

Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Marshall Co., L. H., 270 W. Lane, Columbus 1, O.

HEATERS (Gas, Oil, Electric)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lanly Co., 750 Prospect Ave., Cleveland 15, Ohio.

HEATERS (High Frequency Electric)

Ajax Electrothermic Corp., Trenton, N. J.

HEATERS (Indirect Fired)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

HEATERS (Space, Unit, Direct Fired)

Dravo Corp., Neville Island, Pittsburgh 25, Pa.
Drying Systems, Inc., 1801 Foster Ave., Chicago 40, Ill.

HEATERS (Space, Unit, Oven, Water)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

HELMETS (Blasting)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
American Optical Co., Southbridge, Mass.
B. F. McDonald Co., 5112 South Hoover St., Los Angeles 37, Calif.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

HELMETS (Welding)

American Optical Co., Southbridge, Mass.

HOISTS (Air)

Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Curtis Pneumatic Machinery Div. Curtis Mfg. Co., 1943 Kienlen Ave., St. Louis 20, Mo.
Gardner-Denver Co., Quincy, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.

HOISTS (Chain)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.

HOISTS (Electric)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Modern Equipment Co., Port Washington, Wis.
Shepard-Niles Crane & Hoist Corp., Montour Falls, N. Y.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

HOISTS (Hand)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.

HOISTS (Hydraulic)

Miller Motor Co., 4027 N. Kedzie, Chicago 18, Ill.

HOODS (Shakeout, pouring)

Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.

HOPPERS (Sand)

Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.

HOSE (Air, Blasting, Water, Gas)

Boston Woven Hose & Rubber Co., 29 Hampshire, Cambridge 39, Mass.
Gardner-Denver Co., Quincy, Ill.
Hewitt Rubber Div. Hewitt-Robins Div., Inc., 240 Kinsington Ave., Buffalo 5, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Pangborn Corp., Hagerstown, Md.
Raybestos-Manhattan, Inc., Manhattan Rubber Div., Passaic, N. J.
Schramm Inc., West Chester, Pa.

HOSE FITTINGS

Boston Woven Hose & Rubber Co., 29 Hampshire, Cambridge 39, Mass.

HYDRAULIC CLEANING EQUIPMENT

Pangborn Corp., Hagerstown, Md.

HYDRO FINISHING EQUIPMENT

Pangborn Corp., Hagerstown, Md.

ILLUMINATORS (X-Ray Films)

Eastman Kodak Co., Rochester, N. Y.

IMPREGNATING SYSTEMS

Empire Varnish Co., 2636 E. 76th St., Cleveland 4, O.
Tincher Products Co., Sycamore 12, Ill.

INDUSTRIAL ENGINEERING SERVICE

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Frontier Bronze Corp., 818 Elmwood Ave., Niagara Falls, N. Y.

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R. Lavin & Sons Inc., 3426 So. Kedzie Ave., Chicago 23, Ill.
Northwestern Iron & Metal Co., 900 "T" Street, Lincoln, Nebraska.
Sonken-Galamba Corp., Kansas City 18, Kansas.
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INJECTION MOLDING MACHINES

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LINSEED OIL

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Ottawa Silica Co., Ottawa, Ill.
Pangborn Corp., Hagerstown, Md.
Producers Core Sand Corp., Michigan City, Ind.
Standard Silica Corp., 209 So. LaSalle St., Chicago 4, Ill.
Titanium Alloy Mfg. Div., National Lead Co., Hyde Park Blvd., Niagara Falls, N. Y.
Wedron Silica Co., 38 So. Dearborn St., Chicago, Ill.

SAND BLAST BARRELS

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

SAND BLAST CABINETS

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

SAND BLAST EQUIPMENT

American Air Filter Co., 266 Central Ave., Louisville 8, Ky.
American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

SAND BLAST NOZZLES

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Norton Company, Worcester 6, Mass.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

SAND BLAST ROOMS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

SAND BLAST TABLES

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

SAND BLAST CONDITIONERS

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.

SAND CONTROL & TESTING EQUIPMENT

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

SAND CONVEYING and HANDLING EQUIPMENT

American Air Filter Co., Louisville 8, Ky.
Ajax Flexible Coupling Co., Westfield, N. Y.
C. O. Bartlett & Snow Co., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Clark Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.
Clearfield Machine Co., Clearfield, Pa.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.

SAND CONVEYING and HANDLING EQUIPMENT (Cont'd.)

Frank G. Hough Co., Libertyville, Ill.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Joy Mfg. Co., Joy Division, Pittsburgh, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Newaygo Engineering Co., Newaygo, Mich.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Penn Iron Works, Reading, Pa.
Royer Foundry & Machine Co., Kingston, Pa.

SAND CONVEYING and HANDLING EQUIPMENT (Pneumatic)

Fuller Company, Catasauqua, Pa.
Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.

SAND COOLING SYSTEMS

Newaygo Engineering Co., Newaygo, Mich.

SAND (Core, molding, Blasting)

Titanium Alloy Mfg. Div., National Lead Co., Hyde Park Blvd., Niagara Falls, N. Y.

SAND DRYERS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, Ohio.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y.

SANDERS (Pneumatic)

Cleco Division of Reed Roller Bit Co., Houston, Texas.

SANDING MACHINERY (Disc, Spindle, Belt, etc.)

Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Oliver Machinery Company, Grand Rapids 2, Mich.

SAND MEASURING and WEIGHING DEVICES

Baker Perkins Inc., Saginaw, Mich.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

SAND MIXERS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Baker Perkins Inc., Saginaw, Mich.
Beardsley & Piper Co., The, 2424 N. Cicero, Chicago 39, Ill.
Buckeye Products Co., 7022 Vine St., Cincinnati 16, Ohio.
Clearfield Machine Co., Clearfield, Pa.
Construction Machinery Corp., Waterloo, Iowa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, Ohio.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Multiplex Machinery Corp., Elmore, Ohio.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Royer Foundry & Machine Co., Kingston, Pa.

SAND PREPARATION EQUIPMENT

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
Ajax Flexible Coupling Co., Westfield, N. Y.

SAND PREPARATION EQUIPMENT (Cont'd.)

Baker Perkins Inc., Saginaw, Mich.
Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The, 2424 N. Cicero, Chicago 39, Ill.
Buckeye Products Co., 7022 Vine St., Cincinnati 16, Ohio.
Clearfield Machine Co., Clearfield, Pa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, Ohio.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Moulders Friend, Dallas City, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Royer Foundry & Machine Co., Kingston, Pa.
Simplicity Engineering Co., Durand, Mich.

SAND RAMMERS

Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas.
Dayton Pneumatic Tool Co., Dayton 1, O.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
Master Pneumatic Tool Co., Inc., Orwell, Ohio.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.

SAND RECLAIMERS

Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y.
Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

SAND SIFTING and SCREENING MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
American Air Filter Co., Louisville 8, Ky.
Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, Ohio.
Beardsley & Piper Co., The, 2424 N. Cicero, Chicago 39, Ill.
Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Foundry Supplies & Mfg. Co., 2221 Orchard St., Chicago 14, Ill.
Great Western Mfg. Co., Leavenworth, Kansas.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Royer Foundry & Machine Co., Kingston, Pa.
Simplicity Engineering Co., Durand, Mich.
Pangborn Corp., Hagerstown, Md.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

SAND STORAGE BINS & GATES

Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, Ohio.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Jeffrey Mfg. Co., Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Neff & Fry Co., Camden, O.

SAWS (Band, Metal, Wood)

Atlantic Saw Mfg. Co., New Haven, Conn.
Oliver Machinery Company, Grand Rapids 2, Mich.

SAWS (Cold Metal)

Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

SCALING HAMMERS

Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.
Schramm, Inc., West Chester, Pa.

SCREENS (Shake-Out)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Barlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, Ohio.
Beardsley & Piper Co., 2424 N. Cicero, Chicago 39, Ill.
Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Simplicity Engineering Co., Durand, Mich.

SCREENS (Vibrating)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Ajax Flexible Coupling Co., Westfield, N. Y.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.
Simplicity Engineering Co., Durand, Mich.

SEA COAL

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Frederic B. Stevens, Inc., Detroit 16, Mich.

SEPARATORS (Abrasive)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

SEPARATORS (Air, Moisture, Oil)

American Air Filter Co., Louisville 8, Ky.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
Dollinger Corp., 36 Centre Park, Rochester 4, N. Y.
Jas. A. Murphy & Co., Hamilton, O.
Pangborn Corp., Hagerstown, Md.

SEPARATORS (Magnetic)

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Dings Magnetic Separator Co., 4740 Electric Ave., Milwaukee 7, Wis.
Homer Mfg. Co., Lima, Ohio.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

SHAKE-OUT MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
American Air Filter Co., Louisville 8, Ky.
Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
New Haven Vibrator Co., 131 Chesnut St., New Haven 7, Conn.

SHAKE-OUT MACHINERY (Cont'd.)

Robins Conveyors, Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.
Royer Foundry & Machine Co., Kingston, Pa.
Simplicity Engineering Co., Durand, Mich.

SHOT AND GRIT

Alloy Metal Abrasive Co., 311 W. Huron St., Ann Arbor, Mich.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
American Steel Abrasives Co., Galion, O.
Carpenter Brothers, Inc., 606 West Wisconsin, Milwaukee 3, Wis.
Clayton Sherman Abrasives Co., 3896 Lonyo Rd., Detroit 10, Mich.
Cleveland Metal Abrasive Co., 887 E. 67th St., Cleveland, Ohio.
Globe Steel Abrasive Co., Mansfield, O.
Hickman-Williams & Co., Union Commerce Bldg., Cleveland 14, O.
Metal Blast, Inc., 871 E. 67th St., Cleveland, Ohio.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh 1, Pa.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.
Steel Shot & Grit Co., Inc., 39 Warren Ave., Boston, Mass.

SHOT (Peening)

Alloy Metal Abrasive Co., 311 W. Huron St., Ann Arbor, Mich.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
American Steel Abrasive Co., Galion, O.
Cleveland Metal Abrasive Co., 887 E. 67th St., Cleveland, Ohio.
Globe Steel Abrasive Co., Mansfield, Ohio.
Metal Blast, Inc., 871 E. 67th St., Cleveland, Ohio.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh 1, Pa.
Steel Shot & Grit Co., Inc., 39 Warren Ave., Boston, Mass.

SHOVELS

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Frederic B. Stevens, Inc., Detroit 16, Mich.

SHOVELS (Power)

Clark Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.
Frank G. Hough Co., Libertyville, Ill.

SILICA FLOUR

Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5, O.
Ottawa Silica Co., Ottawa, Ill.
Standard Silica Corp., 209 So. LaSalle St., Chicago 4, Ill.
Wedron Silica Co., 38 So. Dearborn St., Chicago, Ill.

SILICOMANGANESE

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

SILICON (Briquets)

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Ohio Ferro-Alloys Corp., Canton 2, Ohio.

SILICON CARBIDE (Briquets)

Carborundum Co., Perth Amboy, N. J.

SILVERY PIG IRON see Pig Iron (Silvery)

SKIMMERS

Tamms Industries Inc., 228 N. LaSalle St., Chicago 1, Ill.

SKIP HOISTS

Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Gardner-Denver Co., Quincy, Ill.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.
Whiting Corporation, 1560 Lathrop Ave., Harvey, Ill.

SLIP FLASKS

Adams Co., Dubuque, Iowa.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

SLINGS (Chain)

Jeffrey Mfg. Co., Columbus 16, O.

SLIP JACKETS

Adams Co., Dubuque, Iowa.
Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

SMELTERS & REFINERS

Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5.
R. Lavin & Sons Inc., 3426 So. Kedzie Ave., Chicago 23, Ill.

SNAGGING BELTS

Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul 6, Minn.

SNAGGING MACHINES

Bradford Machine Tool Co., 659 Evans St., Cincinnati, Ohio.

SNAGGING WHEELS—See ABRASIVE WHEELS

SNAP FLASKS

Adams Co., Dubuque, Iowa.
Diamond Clamp & Flask Co., Richmond, Ind.
Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5, Ohio.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
V-G Flask & Fitting Co., Clinton, Conn.

SODA ASH

Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5, Ohio.
Hercules Powder Co., Wilmington 99, Del.
Mathieson Chemical Corp., Mathieson Bldg., Baltimore 3, Md.
Solvay Sales Division, Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

SOLDER

Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5.

SPACE HEATERS

Dravo Corp., Neville Island, Pittsburgh 25, Pa.

SPECIAL FOUNDRY ALLOYS

Federated Metals Division of American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.
Niagara Falls Smelting & Refining Div. Continental-United Industries Co., Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.
Vanadium Corp. of America, 420 Lexington Ave., New York, N. Y.

SPRAY GUNS

Murphy & Co., Jas. A., Hamilton, O.
New Haven Vibrator Co., 131 Chestnut St., New Haven 7, Conn.

SPRUE CUTTERS

Adams Co., Dubuque, Iowa.
Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5, Ohio.
Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.
Milwaukee Chaplet & Mfg. Co., 1023 S. 40th St., Milwaukee, Wis.
Rice Pump & Machine Co., 1026 S. 40th St., Milwaukee 15, Wis.

STACKING BOXES

Palmer-Shile Co., 1600 Fullerton Ave., Detroit 27, Mich.

STEEL SHOT

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Steel Shot Producers, Inc. Butler, Pa.

STEEL (Structural)

American Bridge Co., Pittsburgh 19, Pa.

STOPPERS (Graphite)

Joseph Dixon Crucible Co., Monmouth St., Jersey City, N. J.

STRAINER CORES

Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.

STRIPPING MACHINES

Adams Co., Dubuque, Iowa.
Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Devenport Machine & Foundry Co., Davenport, Iowa.
International Molding Machine Co., LaGrange Park, Ill.
Milwaukee Foundry Equipment Div., Spo Inc., 3238 W. Pierce St., Milwaukee 4, Wis.

SURFACE TREATMENT METALS

Pangborn Corp., Hagerstown, Md.

TANKS (Dewatering)

Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.

TAPE (Friction & Rubber)

Boston Woven Hose & Rubber Co., 29 Hampshire, Cambridge 39, Mass.

TAPER PINS

Standard Horse Nail Corp., New Brighton, Pa.

TELLURIUM

American Smelting & Refining Co., 120 Broadway, New York 5, N.Y.

TEMPERATURE CONTROLLERS

Foxboro Company, Foxboro, Mass.
Illinois Testing Laboratories, Inc., 418 N. LaSalle St., Chicago 10, Ill.
Marshall Co., L. H., 270 W. Lane, Columbus 1, O.

TESTING EQUIPMENT

Detroit Testing Machine Co., 19390 Grinnell Ave., Detroit 13, Mich.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Steel City Testing Machines Inc., 8843 Livernois Ave., Detroit 4, Mich.

TESTING MACHINES (Tensile)

Harry Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
Detroit Testing Machine Co., 19390 Grinnell Ave., Detroit 13, Mich.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Steel City Testing Machines Inc., 8843 Livernois Ave., Detroit 4, Mich.

THERMOCOUPLES

Elematic Equipment Corp., 1150 W. Marquette, Chicago 2, Ill.
Illinois Testing Laboratories, Inc., 418 N. LaSalle St., Chicago 10, Ill.
Marshall Co., L. H., 270 W. Lane, Columbus 1, O.
Pyrometer Instrument Co., Bergenfield, N. J.
Tamms Industries Inc., 228 N. LaSalle St., Chicago 1, Ill.

TIERING MACHINES (Power)

Clark Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.

TIMERS (Electric)

Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.

TIN

Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

TIRES (Band Saw)

Carter Products, Grand Rapids, Mich.

TONGS

Industrial Equipment Co., Minster, O.

TOOLS ((Pneumatic Portable)

Arrow Tools Inc., 1900 S. Kostner, Chicago, Ill.
Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Dayton Pneumatic Tool Co., Dayton 1, O.
Gardner-Denver Co., Quincy, Ill.
Independent Pneumatic Tool Co., Aurora, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Schramm Inc., West Chester, Pa.

TORCHES and BURNERS (Acetylene, gas, Oil)

Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.
Hauck Mfg. Co., 106 Tenth St., Brooklyn 15, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17.

TOTE BOXES (see "BOXES-TOTE")

TRACTOR (Gas Powered)

Clark Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.
Frank G. Hough Co., Libertyville, Ill.

TRADE ASSOCIATIONS

Crucible Manufacturers Association, 90 West St., New York 6, N. Y.

TRAMRAIL SYSTEMS

American MonoRail Co., 13104 Athens Ave., Cleveland 7, Ohio
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Modern Equipment Co., Port Washington, Wis.

TRAPS

Jas. A. Murphy & Co., Hamilton, Ohio.

TROLLEYS

Curtis Pneumatic Machinery Div. Curtis Mfg. Co., 1943 Kienlen Ave., St. Louis 20, Mo.
Modern Equipment Co., Port Washington, Wis.

TRUCK CRANES

Silent Hoist & Crane Co., 885 63rd St., Brooklyn 20, N. Y.

TRUCK WHEELS

Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

TRUCKS (Casting)

Kwix-Mix Co., Port Washington, Wis.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

TRUCKS (Core)

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.

TRUCKS (Core Oven)

Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

TRUCKS (Power Lift)

Clark Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.
Frank G. Hough Co., Libertyville, Ill.
Towmotor Corp., 1226 East 152nd St., Cleveland 10, Ohio

TUBES (Annealing)

Pressed Steel Co., Wilkes-Barre, Pa.

TUBES (X-Ray)

General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

TUMBLING BARRELS

Royersford Foundry & Machine Co., Royersford, Pa.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

TURNTABLES

Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Modern Equipment Co., Port Washington, Wis.
Newaygo Engineering Co., Newaygo, Mich.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

UNIT HEATERS

Dravo Corp., Neville Island, Pittsburgh 25, Pa.

VALVES (Air, Water, Steam)

Air-Way Pump & Equipment Co., 1050 N. Kilbourn, Chicago, Ill.

VALVES (Blow-off and Cut-off)

Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Wm. H. Nichols Co., Richmond Mill, Long Island 18, N. Y.

VALVES (Oxygen, Acetylene)

Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

VENTILATING SYSTEMS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Hartzell Propeller Fan Co., Piqua, Ohio

VENTILATING SYSTEMS (Cont'd.)

Joy Mfg. Co., La-Del Division, New Philadelphia, Ohio.
Pangborn Corp., Hagerstown, Md.
Schneible Co., Claude B., 2827—25th St., Detroit 16, Mich.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.
Westinghouse Electric Corp., B. F. Sturtevant Div., 40 Wall St., New York 4, N. Y.

VENTS (Core Box)

Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Demmler & Bros., Wm., Kewanee, Ill.
C. M. Smillie & Co., 1124 Woodward Hgts. Blvd., Ferndale 20, Mich.

VIBRATORS

Adams Co., Dubuque, Iowa.
Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Cannon Vibrator Co., 1111 Power Ave., Cleveland 14, Ohio.
Cleveland Vibrator Co., 2828 Clinton Ave., W., Cleveland 13, Ohio.
Davenport Machine & Foundry Co., Davenport, Iowa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Foundry Supplies & Mfg. Co., 2221 Orchard St., Chicago 14, Ill.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.
New Haven Vibrator Co., 131 Chestnut St., New Haven 7, Conn.
Nichols Co., Wm. H., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
S P O Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.
Syntron Company, Homer City, Pa.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

VIBRATORS (Core Bench)

Cleveland Vibrator Co., 2828 Clinton Ave., W., Cleveland 13, Ohio.
Martin Engineering Co., Kewanee, Ill.

VISES, HYDRAULIC (Machinists & Patternmakers)

Columbian Vise & Mfg. Co., 9021 Bessemer Ave., Cleveland, Ohio.

WASH ROOM EQUIPMENT

Bradley Washfountain Co., Box 732, Milwaukee 1, Wis.

WAX (Core, Vent, Pattern)

United Compound Co., Inc., 328 South Park Ave., Buffalo 4, N. Y.

WEDGES (Foundry)

Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

WELDING GAS

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

WELDING APPARATUS (Electric arc)

Air Reduction Sales Co., 60 East 42nd St., New York 17, N.Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

WELDING and CUTTING APPARATUS and SUPPLIES

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

WELDING ELECTRODES (Carbon)

National Carbon Co., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.
United States Graphite Co., Saginaw, Mich.

WELDING RODS & ELECTRODES

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.
McKay Co., 1005 Liberty Ave., Pittsburgh 22, Pa.

WETTING AGENTS

Peiron Corp., 7740 West 47th St., Lyons, Illinois

WHEELBARROWS

Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis

WHEELS, ABRASIVE (Cut-off)

Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., Perth Amboy, N. J.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Norton Company, Worcester 6, Mass.
Raybestos-Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.

WHEELS (Wire)

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.

WIRE BENDERS

Redford Iron & Equipment Co., 20733 Glendale Ave., Detroit 23, Mich.

WIRE BRUSHES

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.

WIRE CUTTERS

Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5, Ohio.
Redford Iron & Equipment Co., 20733 Glendale Ave., Detroit 23, Mich.

WIRE NAILS

Republic Steel Corp., 3100 E. 45th St., Cleveland 4, Ohio.

WOODWORKING MACHINERY

Oliver Machinery Co., Grand Rapids 2, Mich.

X-RAY EQUIPMENT

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

X-RAY FILMS

Eastman Kodak Co., Rochester, N. Y.
General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

ZINC

Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

CLASSIFIED ADVERTISING

Help Wanted

CORE ROOM SUPERVISOR

For large Michigan foundry. Must have experience in producing cylinder blocks. Give complete history and salary expected. All replies confidential.

BOX 326
FOUNDRY CLEVELAND 13, OHIO

FOUNDRY SALES & SERVICE ENGINEER

For Eastern territory. Must have experience in iron and steel foundry sand control, as well as customer contacts.

BOX 322
FOUNDRY CLEVELAND 13, OHIO

STEEL FOUNDRY MAN

OPPORTUNITIES FOR EXPERIENCED SUPERVISORS IN ALL OPERATING DEPARTMENTS AND MECHANICAL TRADES OF LARGE STEEL FOUNDRY. GOVERNMENT OWNED DEFENSE PLANT IN CHICAGO AREA TO BE OPERATED ON ARMOR STEEL CASTINGS. COMPANY OPERATING SET-UP SUFFICIENTLY LARGE AND AGGRESSIVE TO AFFORD PERMANENT OPPORTUNITY TO MEN WHOSE PERFORMANCE PROVES TO BE OUTSTANDING.

BOX 323
FOUNDRY CLEVELAND 13, OHIO

FOUNDRY FOREMAN

To supervise operation of three large jolt roll-over mold draw from pattern machines also three large jolt stripper pin lift machines, two large core blowers and one bench core blower. Must be practical molder and coremaker, understanding core assembly molds poured without flasks, able to instruct both experienced molders and coremakers and unexperienced personnel. Address: Box 291, FOUNDRY, Cleveland 13, Ohio.

SALES ENGINEER

Manufacturer of foundry facings and core oils requires sales engineer to cover Western Ohio. Address: Box 309, FOUNDRY, Cleveland 13, Ohio.

METALLURGICAL ENGINEER

To take charge of all melting, sand control and laboratory in midwestern malleable foundry. Address: Box 331, FOUNDRY, Cleveland 13, Ohio.

STEEL FOUNDRY SUPERINTENDENT

EXECUTIVE TYPE WITH EXCELLENT FOUNDRY TECHNICAL KNOWLEDGE IN THE MANUFACTURE OF INTRICATE QUALITY ELECTRIC STEEL CASTINGS UP TO 20,000 LBS. WEIGHT. WOULD BECOME AN IMPORTANT MEMBER OF A VERY PROGRESSIVE, ALERT MANAGEMENT WITH GOOD POTENTIAL. ALL REPLIES HELD IN STRICT CONFIDENCE. LOCATION—EAST. ADDRESS: BOX 298, FOUNDRY CLEVELAND 13, OHIO

EXPERIENCED FOUNDRYMAN

Midwestern gray iron foundry desires experienced man capable of supervising production and assembly of small to medium sized cores. Must be able to teach and coordinate making of cores on benches and coreblowers. In replying please state age, experience and salary expected. Address: Box 302, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERVISOR

Wanted for Main Bay by one of largest jobbing gray iron shops in Midwest, castings up to 20 tons. Address: Box 301, FOUNDRY, Cleveland 13, Ohio.

Help Wanted

CHIEF METALLURGIST

ATTRACTIVE FUTURE WITH A GROWING, PROGRESSIVE COMPANY. METALLURGICAL ENGINEERING GRADUATE, FIVE YEARS' EXPERIENCE MELTING AND HEAT TREATMENT OF CAST STEEL. LOCATION—NEW JERSEY. SALARY OPEN. ADDRESS: BOX 299, FOUNDRY, CLEVELAND 13, OHIO.

GENERAL FOUNDRY FOREMAN

Steel foundry in New England producing small and medium sized carbon and alloy castings has opening for General Foreman. Please state age, experience and salary desired in reply. Interview can be arranged. All replies kept confidential. Address: Box 311, FOUNDRY, Cleveland 13, Ohio.

PLANT ENGINEER

ATTRACTIVE FUTURE WITH AN ALERT, PROGRESSIVE COMPANY. OPERATIONS INCLUDE A STEEL FOUNDRY AND MACHINE SHOPS THEREWITH. MECHANICAL GRADUATE OR EQUIVALENT WITH MAINTENANCE EXPERIENCE. LOCATION—NEW JERSEY. SALARY OPEN. ADDRESS: BOX 300, FOUNDRY, CLEVELAND 13, OHIO.

FOUNDRY MANAGER

Man qualified to handle all office details and general management of production foundry in Mid West. Forward complete qualifications and salary expected. Address: Box 307, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERVISOR

For a gray iron foundry in Western Pennsylvania melting 10 to 15 tons per day. Thorough experience in cupola operation, molding and core room practice, sand control and chilled castings. We operate our own pattern shop. Please give personal experience, history, availability and salary expected. Address: Box 233, FOUNDRY, Cleveland 13, Ohio.

CORE ROOM FOREMAN

For electric steel foundry in the Los Angeles area. Prefer man between ages of 35 to 45. When writing please give personal history, experience, availability and salary expected. Address: Box 306, FOUNDRY, Cleveland 13, Ohio.

SUPERVISOR

For large Michigan grey iron foundry. Must have foundry department experience in producing heavy automotive castings. Give complete history and salary expected. All replies confidential.

BOX 325
FOUNDRY CLEVELAND 13, OHIO

CLEANING ROOM FOREMAN

Steel foundry in New England producing small and medium sized carbon and alloy castings has opening for cleaning room foreman. Please state age, experience and salary desired in reply. Interview can be arranged. All replies kept confidential. Address: Box 312, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY FOREMAN

Able to read blue prints; estimate costs for quotation purposes from blue prints; set up jobs in foundry; set up production molding rates; also as field man to select jobs for foundry. Must be well qualified. Address: Box 319, FOUNDRY, Cleveland 13, Ohio.

VICE PRESIDENT OR GENERAL MANAGER MALLEABLE IRON FOUNDRY

Company requires services of executive in production and sale of malleable castings in jobbing foundry. Position requires broad experience in all phases of business management. Will consider candidates who have suitable engineering, metallurgical and business background whose experience has been elsewhere than in malleable castings industry. Duties and salary commensurate with experience and ability. Send brief resume of education and experience. Interview will be arranged on confidential basis. Address: Box 335, FOUNDRY, Cleveland 13, Ohio.

Help Wanted

MECHANICAL ENGINEER

With several years' experience, preferably familiar with foundry operations, to work on plant layout and production methods in New England plant. In replying give age, training, experience and salary expected. Address: Box 303, FOUNDRY, Cleveland 13, Ohio.

SALESMAN

To sell foundry supplies and equipment in Michigan. Address: Box 310, FOUNDRY, Cleveland 13, Ohio.

Representatives Wanted

MANUFACTURERS' REPRESENTATIVE

To sell complete line of Air Compressors and Hose Reels especially adapted to foundry use. Line backed by Nationwide Service. Liberal commissions and promotional aids.

THE WAYNE PUMP COMPANY
FORT WAYNE, INDIANA
DEPT. RPE FOR FULL PARTICULARS

Positions Wanted

METALLURGIST

Graduate, age 36. Fourteen years' diversified experience in ferrous foundry research and development, heat treating, stress analysis, radiography and trouble shooting. Interested in development of nodular iron. Capable of directing metallurgical control and research program. Address: Box 297, FOUNDRY, Cleveland 13, Ohio.

GENERAL SUPERINTENDENT

Over 20 years with present employer in supervisory capacity in fully mechanized automotive foundry desires change. Age 49—31 years' experience in gray iron covers all phases of production practices on all types automotive—agricultural and furnace castings. Address: Box 272, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY MANAGER OR SUPERINTENDENT

Available. Practical and technical experience, 25 years in supervisory capacity. 15 years in present connection. Molder and coremaker. Thorough in cupola operation. Mix iron by analysis. Understand foundry cost. Present location—Cincinnati, Ohio district. Address: Box 318, FOUNDRY, Cleveland 13, Ohio.

INDUSTRIAL ENGINEER

Standards, methods, production and cost control. Will assist management in operating of plant. Several years' experience in foundry industrial engineering work. Let me reduce your cost. Address: Box 321, FOUNDRY, Cleveland 13, Ohio.

STEEL FOUNDRYMAN

15 years' experience covering all phases of steel foundry operation, including application of wage incentives, labor relations, job costing as well as molding, melting, etc. Metallurgical engineering graduate. Age 39, married. Now employed as manager. Address: Box 317, FOUNDRY, Cleveland 13, Ohio.

GENERAL MANAGER

Mature, profit-minded, dependable. Has successfully managed four companies—two taken out of the red. Available for service shortly with medium-size company requiring reliable directing ability in management, sales finance and production. Excellent experience, foundry, machine and related lines. Address: Box 235, FOUNDRY, Cleveland 13, Ohio.

CLASSIFIED ADVERTISING

Positions Wanted

CLEANING ROOM FOREMAN

35 years' experience. Experienced in all types of steel castings—railroad, pressure, navy, machine steel and all types of miscellaneous castings from one pound up. Also capable of handling inspection. Address: Box 194, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY FOREMAN

Grey iron foundry foreman wants position in jobbing shop west of the rockies. 30 years' experience—14 as foreman. Address: Box 314, FOUNDRY, Cleveland 13, Ohio.

GENERAL FOREMAN

Under 45, supervisor 18 years' gray iron production molding. Four years acid electric steel castings. Complete knowledge of melting cupola and electric furnace also molding and sand control. References. Address: Box 330, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY EXECUTIVE

Graduate industrial engineer—16 years' manufacturing experience—10 years in gray iron foundry including superintendent, industrial engineer and management. Now employed—39—married. Address: Box 334, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY MANAGER
OR
SUPERINTENDENT

Practical, progressive, experience of 27 years in small, medium and large castings in cast iron and nonferrous metals. Take charge of all phases of work in office and foundry. Employed. Address: Box 316, FOUNDRY, Cleveland 13, Ohio.

NONFERROUS FOUNDRY MANAGER
OR SUPERINTENDENT

Twenty-four years' experience—over 18 years in supervision, sales and management. Complete practical experience and technical knowledge. Production and jobbing. Address: Box 324, FOUNDRY, Cleveland 13, Ohio.

COREROOM FOREMAN
OR
WORKING FOREMAN

Twenty years' experience in large production iron and steel foundry. Also experience in core making in brass and aluminum. Address: Box 327, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Desires position in gray iron foundry. 25 years' practical experience with medium to heavy work. Well versed in every phase foundry experience. Immediately available. Address: Box 308, FOUNDRY, Cleveland 13, Ohio.

MELTING FOREMAN

Graduate metallurgist. 15 years' experience cupola and electric furnace melting iron to close specifications. Can handle sand control, chemical and physical testing. Address: Box 320, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY MANAGER OR
SUPERINTENDENT

Thirty years' practical experience in gray iron and semi-steel molding, coremaking and cupola. Past 15 years in executive capacity. Well versed in all modern foundry practice and operation. From drawings to finished rough casting. Capable of rigging for high production or jobbing cost and method problems and complete management including sales. Estimating from prints and good labor relations. Good references and available at once. Address: Box 336, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Eighteen years' supervision cast iron plumbing fixtures. Know all phases cupola molding and sand control. Will consider any production foundry. References. Address: Box 329, FOUNDRY, Cleveland 13, Ohio.

Available Capacity

AVAILABLE CAPACITY

For gray iron castings. We specialize in close tolerance production work from a fraction of an ounce to fifty pounds. Also short orders. Are interested in securing D. O. jobs at present. Address: CADILLAC FOUNDRY CO., INC., P. O. BOX 218, CADILLAC, MICHIGAN.

Available Capacity

AVAILABLE CAPACITY

Our foundry has open capacity to supply small and medium size gray iron castings. Send sample. Address: OREGON CASTINGS CO. RD 3, Lititz, Pa.

OPEN FOUNDRY TIME

Large capacity available for small to medium size ferrous and nonferrous castings. Production heat treating facilities.

DONEGAL MANUFACTURING CORP.
635 E. MARKET MARIETTA, PENNSYLVANIA

OPEN CAPACITY

Have open capacity for squeezer work in gray iron. ADDRESS: PHARISBURG FOUNDRY CO., MARYSVILLE, O. R.1.

OPEN CAPACITY

We have available capacity for a limited amount of production on grey iron castings. Up to 1000# castings, some machining. Address: SUPERIOR FOUNDRY AND MACHINE WORKS, P.O. BOX 549, HOPEWELL, VA.

AVAILABLE CAPACITY

We have open capacity for producing light to medium weight gray iron castings, squeezer, bench or floor work. Address: BADGER IRON WORKS, 921 BROADWAY, MENOMONIE, WISCONSIN.

AVAILABLE CAPACITY

Capacity to supply small and medium size gray iron castings. We make Foundry patterns to specifications.

NASHVILLE CASTING CO. INC.
808-10th AVENUE, N. NASHVILLE 4, TENN.

Opportunities

OPPORTUNITY

If you are contemplating relocating, you should request a copy of "Business Opportunities in Watertown, South Dakota". Call or write Mayor Gilbert or the City Promotional Director J. G. Ihnet.

Foundries For Sale

SMALL FOUNDRY FOR SALE

On New York Central Railroad side track in Lockport, New York. Floor space of molders approximately 11,000 square feet with exceptional dumping ground for disposal of slag and waste indefinitely at lowest expense over declivity on the land. Considerable foundry equipment thrown in for the price of assessed value of the real estate. Address: JEFFERSON UNION COMPANY, LOCKPORT, NEW YORK.

GRAY-IRON FOUNDRY

In up-state New York, now operating profitably with complete organization. $80,000 buys this going business, modernly equipped with capacity of 30 tons small castings per week on squeezers. Open shop. Address: Box 276, FOUNDRY, Cleveland 13, Ohio.

Wanted-To-Buy

WANTED

Fifty 13 x 18 single pin steel flasks with 4" cope 3" drag. Address: Box 304, FOUNDRY, Cleveland 13, Ohio.

Wanted-To-Buy

WANTED

3 style 690 Hausfeld tilting furnaces or Fisher MNP for #400 brass crucible. State price and condition.

ROCK ISLAND METAL FOUNDRY, INC.
ROCK ISLAND, ILLINOIS

WANTED

Small or medium gray iron foundry located in upper Midwest. Present management may stay if desired. Light and medium weight castings. Write complete information. Address: Box 287, The FOUNDRY, Cleveland 13, Ohio.

MIXERS WANTED

Used Simpson Intensive Sand Mixers. State size, condition and lowest cash price or immediate acceptance. Address Box 578, FOUNDRY, Cleveland 13, Ohio.

WANTED

One #2 Simpson muller screening unit and magnetic separator. State condition and price in first reply. Address: Box 978, FOUNDRY, Cleveland 13, Ohio.

WANTED TO BUY

1—24" sand conveyor belt complete with rollers for 100 ft. installation.
1—24" sand conveyor belt complete with rollers for 40 ft. installation.

BOX 305
FOUNDRY CLEVELAND 13, OHIO

WANTED

Tumbling mill, minimum clear diameter 36-inches. Minimum length 60-inches clear. Address: INDUSTRIAL IRON WORKS, POST OFFICE BOX 4625, PORTLAND 2, OREGON.

EQUIPMENT WANTED

Grey iron foundry starting business requires American tumblast, jolt squeezers, core blowers, core ovens, jolt rollovers, jolt strippers, pin lifts, snag grinders, air compressors and cutter and other miscellaneous equipment. Send your list and best prices to: Box 333, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY WANTED

Grey iron foundry for light bench molding, sufficient capacity for twenty molders or more. Preferably located between New York and Boston. Address: Box 279, The FOUNDRY, Cleveland 13, Ohio.

WANTED

Pipe fitting patterns conforming to American Standard 125 pound flanged. Also, Bell and Spigot fitting patterns conforming to AWWA Standards. Address: Box 315, FOUNDRY, Cleveland 13, Ohio.

WANTED TO BUY

Soil pipe patterns, 3 in. and 4 in. Also arbors and flasks. Address: CHESANING PIPE CO., CHESANING, MICHIGAN.

For Sale

EQUIPMENT FOR SALE

2—Milwaukee #125 Jolt Squeeze Pin Lifts
1—American Model AA Sandcutter, used 6 months
4—Johnson & Jennings Late Model Jolt Squeezers
2—Osborn #601 Jolt Rollover Pattern Draw Machines
1—S.P.O. Jolt Squeeze Pin Lift Molding Machines
3—International Jolt Squeezers
1—Osborn #243 Jolt Rollover Pattern Draw Machines
4—International Jolt Rollover Pattern Draw Molding Machines
1—Osborn #322-3s Molding Machines
1—Osborn #403 Jolt Rollover Pattern Draw Molding Machines
1—Osborn #275-J Jolt Squeezer
2—Osborn #602 Jolt Rollover Pattern Draw Molding Machines
2—Milwaukee #165 Jolt Squeeze Pin Lifts
1—Osborn #403-W Jolt Rollover Pattern Draw Machines
12—Hand Ram Rockover Core Machines in various sizes.

BOX 332
FOUNDRY CLEVELAND 13, O.

FOR SALE
SAND BLAST EQUIPMENT

Pangborn 28GK 2 Rotoblast barrel, complete with loader. Over $5500.00 spare parts. A-1 condition $5000.00
Pangborn Rotoblast cabinet, type ES-213. Used for cleaning propeller blades. Price new $20,000.00. Now only $3,000.00 as is.
Pangborn 6 foot table without motors. Good condition $1200.00.
Pangborn direct pressure tank, model AQ1, like new $575.00.
Baird tumbling barrel, approximately 2 cubic feet. Complete $250.00.
Rubber Sheets, size 3/8" x 48 x 48 ..... .75c lb.
Sand Blast Cabinets, generators, dust collectors and blowers. All kinds and sizes. Like new. 60% less list price.
Crane—2-ton, twin hook—21' span.....$400.00.
Washing machine and rinse, 19'L x 5'W. Conveyor type $350.00.

DIAMOND SAND BLAST INC.
5654 W. JEFF. AVE.
DETROIT 9, MICHIGAN

SURPLUS SAND BLASTING EQUIPMENT

Pangborn 3N 2 cabinet suction type $275.
Pangborn 6' rotary blast tables $800.
Pangborn 2AQ1 generator with BVR7 abrasive separator elevator $550.
Dust collectors, all sizes and makes.

M. ELSTEIN
141 MANGIN STREET
NEW YORK 2, N. Y.

FOR SALE

12—275 JW Stationary or portable Molding Machines
1—#2 Simpson Mixer with motor
1—80' long Gas Fired Continuous Core Oven
2—1000# C.I. Pot Bellevue Tilting Furnaces
2—350# Detroit Electric Tilting Furnaces with 153 KVA Transformer.
4—Osborne 2047 Rollover Molding Machines
1—International YPD 30" x 72" x 12" Molding Machine
6—Walker-York coke fired Melting Furnaces
24—1 Ton Worm Geared Ladles
1—10 Ton Bottom Pour Ladle
4 Ton, 5 Ton Worm Geared Crane Ladles
2—Swing Frame Grinders, 1—16", 1—22" wheels
WE ARE ALWAYS IN THE MARKET FOR GOOD USED FOUNDRY EQUIPMENT.

UNIVERSAL MACHINERY & EQUIPMENT CO.
320 E. BROAD ST.
SHILLINGTON, READING, PA.
R. B. HARRISON
MANAGER, FOUNDRY DEPT.
PHONES—READING 30311—40146

FOR SALE

Beardsley & Piper #30 sandmuller with cooling hood and skip loader. Excellent condition. Used less than 3 months.
Simplicity Mod. B.G. double deck 3' x 8' shakeout. Excellent condition.

THE SCHAIBLE COMPANY
1086 SUMMER STREET
CINCINNATI 4, OHIO
TELEPHONE: GRANDVIEW 5000

FOR SALE

Baker-Perkins core and sand mixer, 16½ inch blade, 30 HP motor 220/440 volts, serial number 42079. Machine available immediately. Address: EDWARD ANDREWS TOOLS AND MACHINERY, 5842 TIREMAN, DETROIT 4, MICHIGAN.

For Sale

FOR SALE

1—Gardner-Denver 8 x 9 Air Compressor with 25 HP. Motor.
1—3000 lb. Worm Gear Ladle V-Type Bale.
2—JDP. International Jolt Strip Machines.
6—"G" Rollover Machines 20 x 8
3—SPO Jolt Strip Squeeze Molding Machines
4—Osborn J-75 Jolt Squeezers 10"
4—Tabor Jolt Squeezers 10"
1—Electric Riddle
1—Model "M" Beardsley & Piper Screenarator
2—Model"S" Beardsley & Piper Screenarator
2—Jeffrey Sand Conditioners
1—Royer Sand Conditioner
1—Sprue Cutter with 2 HP. Motor
1—#3E Demmler Core Blower
1—North American Blower with 15 HP. Motor, 2100 C.F.M., 16 oz. pressure.
1—North American Blower with 5 HP. Motor, 320 C.F.M. 32 oz. pressure.
6—10" New—Haynes Jolt Squeezers
6—12" New—Haynes Jolt Squeezers
4—#559 Osborn Molding Machines
4—Osborn Jolt Rollover Machines, Model 243
5—Chicago Pneumatic Air Hoists
1—Osborn Molding Machine Model 342
1—International Molding Machine HJ 16 x 6
3—Charging Buckets for #9 Cupola.
1—Redford Core Blower
1—Modern Equipment Co. Worm Gear Receiving Ladle, 3000 lb. capacity.
2—SPO Jolt Squeezers
2—Arcade Jolt Squeezers
1—Arcade Jolt Strip Squeezer
1—International Power Jolt Hand Rollover Table size 20 x 30.
1—International Rollover Type R.
1—Ladle Cart with 5 Ladle Pots, 350 lbs. capacity.
1—Chisholm & Moor Electric Hoist, 2 Ton Capacity.
1—Band Saw

HAYNES FOUNDRY EQUIPMENT CO.
814 ADA ST. KALAMAZOO 52, MICH.

FOR SALE

AMERICAN SANDCUTTER
Model M Size 99/80. Equipped with five 220 volt 60 cycle 3 phase motors; in excellent condition.
ONLY $4,650.00 NET CASH
FOB our plant. This is offered for sale because our foundry department has been discontinued. We invite your inspection.

GILBERT & BARKER MFG. COMPANY
WEST SPRINGFIELD, MASSACHUSETTS

FOR SALE

Herman Pneumatic Independent Turnover and pattern drawing device. 18" cylinder, 3000 lbs., practically new.

THE M. COHEN CO.
HUNTINGTON WEST VIRGINIA

FOR SALE
FIRE BRICK

Wrecking several large brick kilns. Approximately 1,000,000 good used fire brick. Address: The Western Shale Products Co., Ft. Scott, Kansas.

EQUIPMENT FOR SALE

1—Pangborn 6 Ft. Rotoblast Table Cleaning Machine, New 1947, Used Three Months
1—American Sandcutter, Model AA, Used Six Months, Like New.
These machines are available immediately and can be purchased for $4000.00 each.

NARRAGANSETT GREY IRON FDRY., INC.
130 WEST RIVER STREET
PROVIDENCE, R. I.

FOR SALE

246 ft. 18" wide x 8 ply super insulator Sahara conveyor belting 400° to 600° temperature. This is new belting for foundry equipment. Address: Box 283, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE

WHITING POUR-RITE LADLE HANDLERS
1—Model 1000, 2'-6" lift
1—Model 2000, 2'-7" lift
BOTH NEW
1—No. 60 Speedmullor with new style crosshead complete with cooling system, fines removal, water meter and motors, 3/60/220, now in operation.

T. B. WOOD'S SONS CO.
CHAMBERSBURG, PA.

FOR SALE

One (1) drawer type core baking oven-gas fired —10' 6" wide x 6' 0" deep x 7' 6" high inside— 8 drawers with a total shelf area of 150 sq. ft. All controls and safety equipment included. Address: Box 313, FOUNDRY, Cleveland 13, Ohio.

For Sale

FOR SALE

MOLDING MACHINES
1—International Type GR Stationary 24 x 10
1—international Type RJ Stationary 14 x 8
1—International Type G Stationary 24 x 10
1—International Type R Portable 24 x 10
1—International Type F Stationary 26 x 8
1—International Type M Portable 24 x 10
1—Osborn 74W Plain Squeeze Portable
2—Osborn 75W Plain Squeeze Portable
4—Arcade 72-28 Jolt Squeeze Stationary
2—SPO #305 Jolt Strippers
2—SPO #611B Stationary Oscillating Jolt Squeeze Strippers
1—SPO #4½ JHS Jolt Hand Strip
BLOWERS FOR CUPOLAS AND FURNACES
1—Connersville rotary 24 cu. ft. per rev. 6200 C.F.M.
Maxon-Premix Blowers for Gas ¼ to 1 HP
METAL MELTING EQUIPMENT
1—Hausfeld 1450-M Tilting Crucible Furnace, Multiple Burner, 400# aluminum
1—Hausfeld 2000# aluminum capacity furnace, barrel type, open flame, oil fired
New 32" to 41" dia. shell cupolas made to order.
TUMBLING MILLS AND SAND BLAST
2—28 x 56" Round Exhaust Mills
1—Pangborn No. 2 GH direct pressure type sand blast barrel, motor driven, Complete unit.
1—Pangborn Sand Blast Unit, including generator tank, shot cleaner, bucket elevator. Suitable for use with room
MISCELLANEOUS
1—American Sand Cutter 72"
2—#16 Roto-clone units complete
1—Continuous Heat Treat Furnace 57' long, 1200° F. max.
2—Sly Economy #12 Cloth Screen Dust Collectors
1—Demmler #1 Core Blower
1—9 x 8 Ingersoll Rand Air Compressor, with motor
4—Heavy Duty Flexible Shaft Grinders 2 HP
Complete stock of rebuilt mill and dust exhaust blowers

CLIFTON MACHINERY COMPANY
1023 W. SIXTH ST. CINCINNATI 3, OHIO

FOR SALE
MOLDING MACHINES

4—International 20" x 8", Type G
2—International 30" x 12", Type G
4—Osborne Jolt R.O. #243
1—Osborne Jolt R.O. #342
3—Osborne Jolt Strip #559
CORE BLOWER
1—Demmler #3-E, air draw
1—15-ton Whiting 44' 7" Span Crane, 3/60/220

RAY P. SCULLY
SCULLY MACHINERY & EQUIPMENT CO., NOT INC.
767 MILWAUKEE AVE. CHICAGO 22, ILL.
PHONE: CANAL 6-0314

YOUR CLASSIFIED ADVERTISEMENT IN THE FOUNDRY BRINGS RESULTS!

IF YOU ARE SEEKING A CHANGE OF POSITION TO BETTER YOUR SITUATION AND ARE QUALIFIED FOR A BETTER JOB, TELL THE 35,000 READERS OF THE FOUNDRY ABOUT IT.

DON'T "HIDE YOUR LIGHT UNDER A BUSHEL"—THERE ARE TIMES WHEN A MAN SHOULD TALK ABOUT HIMSELF AND THERE ARE A LOT OF MEN QUALIFIED FOR BETTER POSITIONS WHO DO NOT KNOW HOW TO GO ABOUT IT OR WHERE TO SEEK HIGHER RESPONSIBILITIES.

YOUR CLASSIFIED ADVERTISEMENT IN THE FQUNDRY WILL BE WIDELY READ AND THE RESULTS MAY SURPRISE YOU!

IT COSTS BUT LITTLE. WHY NOT RUN AN ADVERTISEMENT ABOUT YOURSELF IN TWO OR THREE ISSUES?

WRITE

FOUNDRY

CLASSIFIED ADVERTISING DEPT.

PENTON BLDG., CLEVELAND 13, OHIO

CLASSIFIED ADVERTISING

FOR SALE

SPECIAL FOR
IMMEDIATE DELIVERY

2—#4 Bishop & Babcock 49" intake, 40½ x 50 outlet, 48" dia. wheel, 8150-62500 cfm.

TURBO BLOWERS (3 Phase, 60 Cycle)

cfm	Pressure	Make	Motor H.P.	Volts	Speed
3500	40 oz.	Spencer	60	440	1800
1000	32 oz.	Spencer	15	220	
900	24 oz.	Spencer	10	220/440	
225	10 oz.	Spencer	1	220/440	3600

PRESSURE BLOWERS (3 Phase, 60 Cycle)

2500	7 oz.	Sturtevant	15	220/440	1800
2400	14 oz.	Mahr	15	220/440	3480
1800	1 in.	Sturtevant	2	220/440	
1000	12 oz.	Nth.Amer.	5	220	3600
950	16 oz.	Nth.Amer.			
800	8 oz.	Sturtevant	7½	220/440	3600
800	8 oz.	Nth.Amer.	3	220	3600
800	24 oz.	American	10	220	3600
667	8 lb.	AllenBillmyre	50	220	3560
450	6 lb.	A&B	30	220/440	3450
340	20 oz.	AllenBillmyre	3	440	3600
275	16 oz.	Nth.Amer.	2	220	3600
150	12 oz.	Nth.Amer.	1	220	3600

MOTOR REPAIR & MFG. CO.
1552 HAMILTON AVENUE
CLEVELAND, OHIO

FOR SALE

1—Champion Pin Lift Molding Machine
2—Osborn Jolt, Squeeze, Rollover, Draw Molding Machine
1—Besly 53" Dia. Surface Disc Grinder
1—Kent-Owens #2 RV Milling Machine
Complete Bessemer Converter Steel Production Equipment Including Shells, Tilting Assemblies, Blower and Motor, and Controls

GUNITE FOUNDRIES CORPORATION
ROCKFORD, ILLINOIS

For Sale

FOR SALE

1—Whiting powdered coal fired holding furnace complete with #3 Whiting Pulverizer with 7½ HP motor.
1—#193 Milwaukee Molding machine in excellent condition, used only 18 months.

NYLEN PRODUCTS CO.
ST. JOSEPH, MICH.

FOR SALE

12,000—#6 GA. x 1½" dia. x 2" long chill coils .0202 ea new clean
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CENTURY ELECTRIC CO.
1806 PINE ST.
ST. LOUIS, MO.

OSBORN JOLT ROLLOVER
MODEL #601-13

With hardened and ground pins and bushings throughout—new 1940

BRM MACHINERY CORPORATION
28 EDISON PLACE NEWARK 2, NEW JERSEY

FOR SALE
MOLDING MACHINES

4—Rapid jolt squeezers, 21 x 14 table, 14 x 18 head, portable type. Used six months. Price $100 each, FOB. Mattoon, Illinois.

H. W. CLARK CO.
MATTOON, ILLINOIS

FOR SALE

One Herman rollover moulding machine, late model, in excellent condition, size 40 x 58" 3740 pounds rollover capacity. Equipped with air clamps. Address: Box 328, FOUNDRY, Cleveland 13, Ohio.

For Sale

GOOD BUYS

#403 Osborn Jolt Rollover Molding Machine with 42" swinging table $450.00
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18 x 22 table 250.00
Jolt Squeezers—#275 JW Osborn.... 125.00 Ea.
54" Horizontal Disc Grinder..... 500.00
Snag Grinders—7½ HP—24" wheel..... 375.00
10 HP—20" wheel..... 450.00
Clark 4000 lb. Fork Lift Truck—Gas 950.00
Clark 6000 lb Platform Truck—Gas 500.00

BALCHER MACHINERY COMPANY
1884 S. COMPTON ROAD
CLEVELAND HEIGHTS 18, OHIO
TEL: FAIRMOUNT 1-1186

FOR SALE

50—12" x 18" 2-pin flasks, 3" cope and #3 drag, A-1 condition. Address: FIELDS CORNER BRASS FOUNDRY, INC., 9 STURTEVANT STREET, DORCHESTER 22, MASS.

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$3,500 to $35,000. We offer the original personal employment service (established 41 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered; present position protected. Ask for particulars. Address: **R. W. BIXBY, INC., 101 DUN BUILDING, BUFFALO 2, NEW YORK.**

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ALL OTHERS—"Help Wanted"—"For Sale"—"Wanted"—"Personals"—"Services", etc., minimum advertisement set solid, 30 words or less, $5.00. Additional words 15c each.

NOTE—If replies are to be sent to a box number in care of THE FOUNDRY, add 6 words to your advertisement for box number and address.

Any advertisement set in all capital letters, add 50% to the above rates.

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Single Column 2¼" Wide	One Time	Three Times	Six Times	Twelve Times
1 inch	$ 15.00	$ 13.75	$ 12.50	$ 11.25
2 inches	27.00	25.00	23.00	21.00
3 inches	40.00	36.50	33.50	30.00
4 inches	50.00	46.00	41.50	37.50
5 inches	60.00	55.00	50.00	45.00
6 inches	73.50	66.50	60.00	53.50
7 inches	82.50	75.00	67.50	60.00
8 inches	91.50	83.50	75.00	66.50
1 column	110.00	100.00	90.00	80.00
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Full Page	275.00	250.00	225.00	200.00

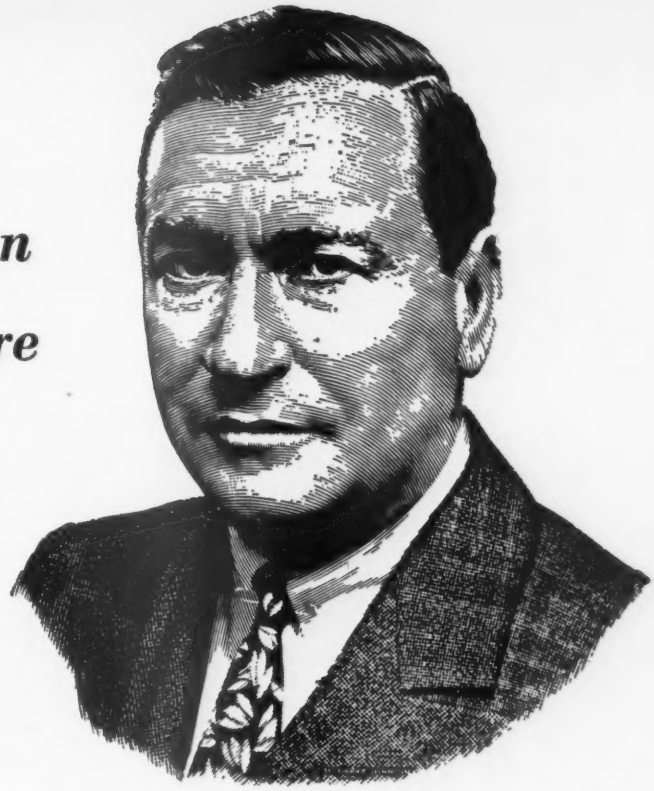
Remittance should accompany advertisement when submitted—Cash Discount 2%, 10 days.

Classified Forms Close the 13th of Month Preceding Issue

FOUNDRY

Penton Building, Cleveland 13, Ohio

"You Build for your own and your country's future when you save . . ."



BENJAMIN F. FAIRLESS

President, U. S. Steel Corporation

"A free economy, such as ours, is built on the savings of the people. And the future security of America depends on the initiative and the growth of every citizen. We in U. S. Steel encourage our employees to join the Payroll Savings Plan, and we are proud that the National Tube Company, one of our subsidiaries, was the first of the large industrial companies of the nation in 1950 to have more than 80% of its employees participating. Remember, you build for your own and your country's future when you save."

Mr. Fairless is not expressing a personal opinion, nor is he speaking for other far-seeing executives when he tells you that our economy is built on the savings of the people and a man builds for his own and his country's future when he saves.

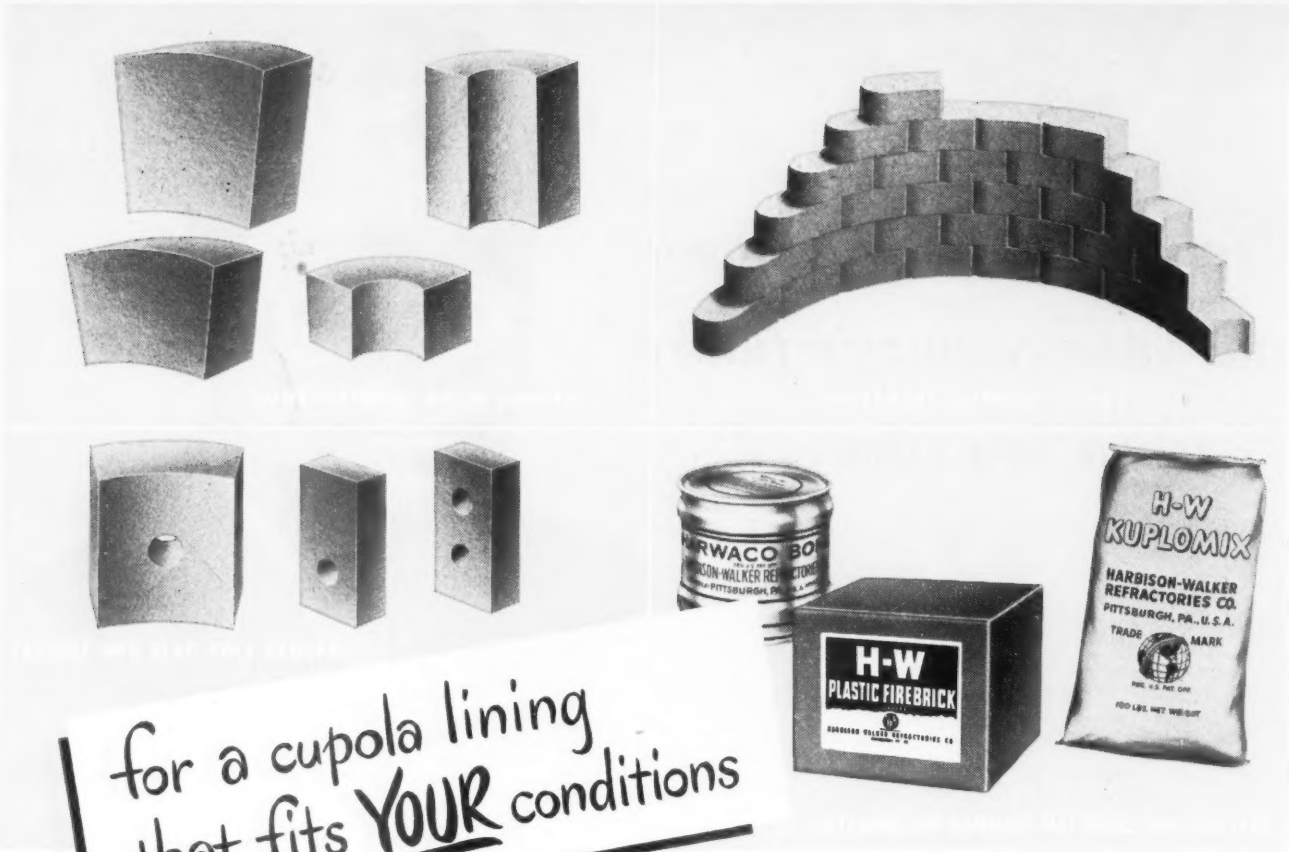
Actually, Mr. Fairless is merely putting in words the thoughts and action of the millions of employed men and women who *now hold* more than 50 billion dollars in U.S. Savings Bonds.

$50,000,000,000! Who *sold* all those bonds to millions of people? The answer is, nobody sold them.

80% of the employees of the National Tube Company . . . 75% of the employees of Carnegie-Illinois Steel Company . . . thousands of employees of other U.S. Steel subsidiaries . . . more than 8 million employees of other companies bought U.S. Savings Bonds and are buying them every month on the easy, automatic Payroll Savings Plan. Their employers merely offered these men and women an opportunity to save for their future. There was no pressure, no emotional appeal.

How does employee participation in *your* Payroll Savings Plan match up with the 80% of National Tube, the 75% of Carnegie-Illinois? Or, perhaps you are one of the relatively few large companies that do not have a Plan? In either case, wire or write, Savings Bond Division, U.S. Treasury Department, Suite 700, Washington Bldg., Washington, D.C. Your State Director is ready to help you with a package plan—application blanks, promotional material, practical suggestions and all the personal assistance you may desire.

The U. S. Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the G. M. Basford Company and



for a cupola lining
that fits YOUR conditions

cupola refractories

Many factors and operating variables, such as the nature of the charge, method of charging, character of the flux and fuel, blast velocity, duration of heat, tapping temperature and continuity of operation influence the lining life.

For best economy, you may need a cupola lining having certain predominant physical and chemical properties. Harbison-Walker offers the complete line of cupola refractories, whether the requirement may demand one which is highly siliceous or highly aluminous, of maximum density or of highest spalling resistance.

For greatest overall economy and continuity of service for cupolas, use Harbison-Walker refractories.

HARBISON-WALKER REFRACTORIES COMPANY

AND SUBSIDIARIES

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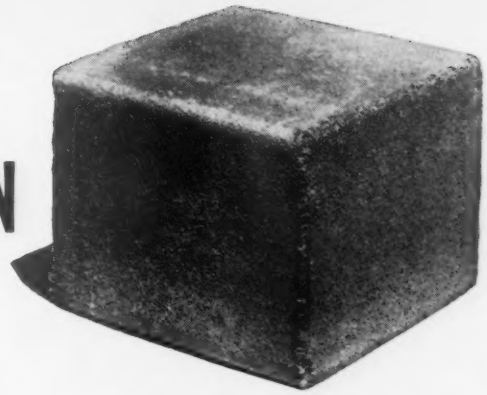
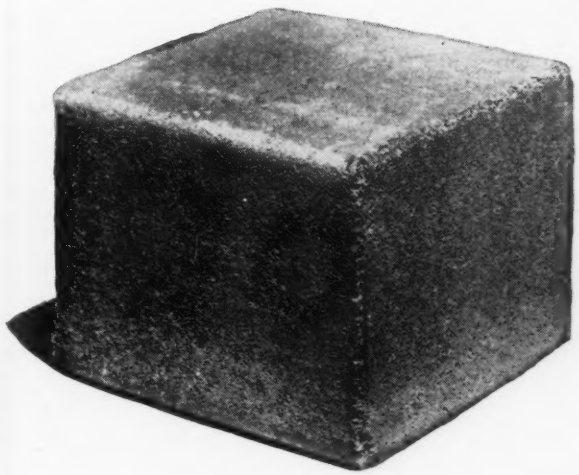
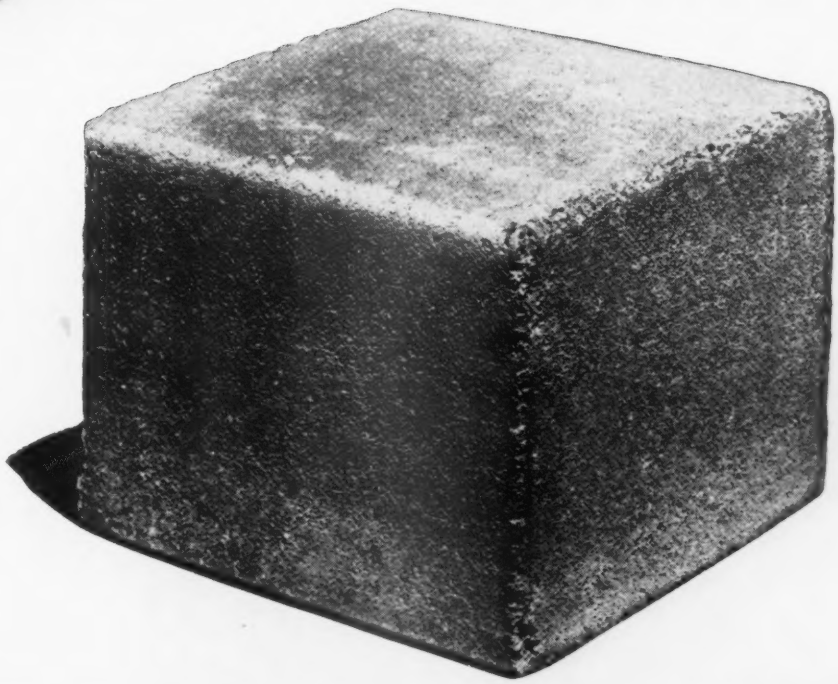
MORE EFFECTIVE DEOXIDATION





FERROCARBO
TRADE MARK
Briquettes



- Made from silicon carbide specially processed for metallurgical use.
- Readily soluble in molten iron, providing thorough deoxidation.
- Super-heated iron of greater fluidity obtained; foundry variables reduced; cleaner, sharper castings poured.
- Easily added to cupola in uniform briquettes.

by CARBORUNDUM
TRADE MARK

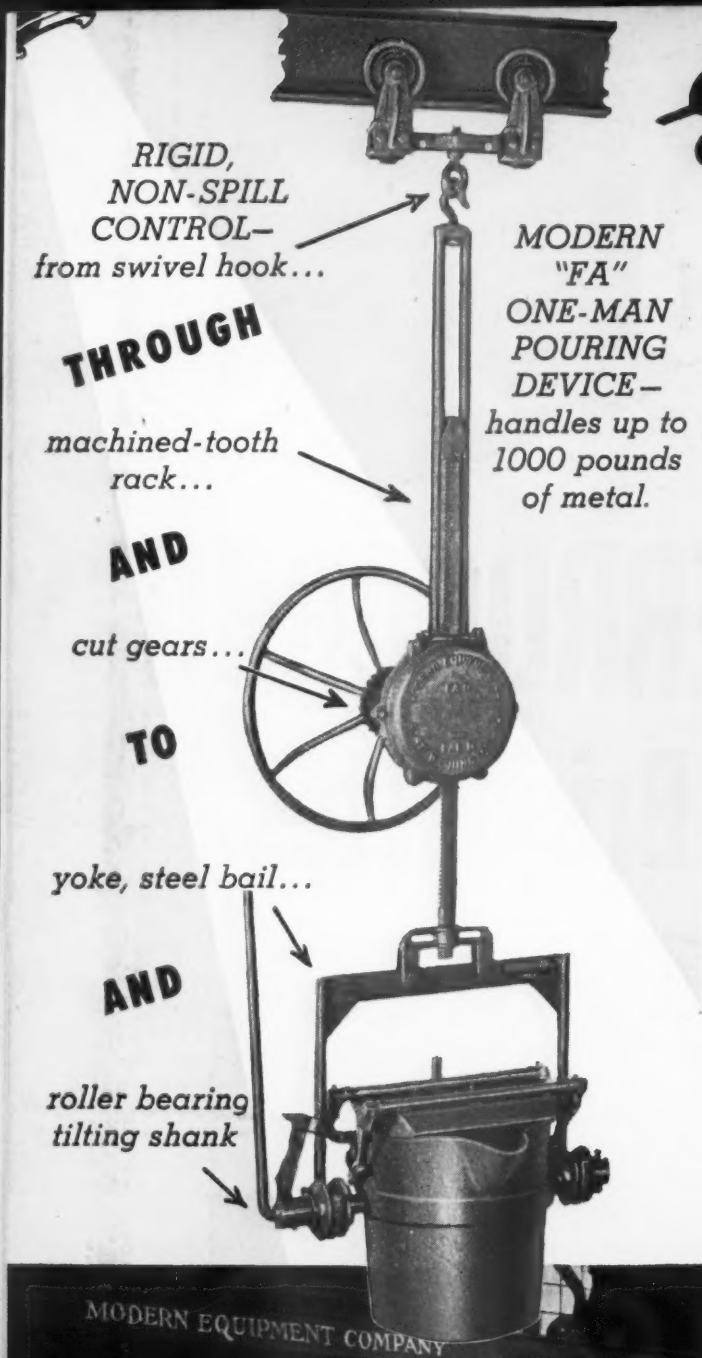
Write or Phone our FERROCARBO Distributors:
KERCHNER, MARSHALL & CO., PITTSBURGH, Cleveland, Birmingham, Philadelphia and Buffalo
MILLER & COMPANY, CHICAGO, St. Louis and Cincinnati

- **FERROCARBO Briquettes** are manufactured under U.S. Patents 2,119,521 and 2,497,745. The process of making cast iron through utilization of silicon carbide is registered under U.S. Patent 2,020,171.

Distributed in Canada by WILLIAMS & WILSON, TORONTO, Montreal and Windsor *and the* CANADIAN CARBORUNDUM COMPANY, LTD., Niagara Falls, Ontario.

"Carborundum" and "Ferrocarbo" are registered trademarks which indicate manufacture by The Carborundum Company, Niagara Falls, N.Y

~~SHORT~~ MORE METAL



WHILE some of our nation's most highly mechanized foundries are producing, 'round the clock, and close to peak capacity—others aren't. Fortunately for everybody many foundries can POUR MORE! Wherever there is any appreciable volume of hand pouring, MODERN can help along with rigid, geared POURING DEVICES. MODERN Pouring Devices and ladles team together to give that all important rigidity from monorail to ladle bail. Tonnage goes up! Scrap comes down! Here in the Sivyer steel foundries in Milwaukee the "FA" Pouring Devices have served faithfully for more than seven years with little attention. The stainless and nickel steels come on at 3200°F. Eight, 37 pound, industrial valve bodies are poured at split second speeds from MODERN 300 pound ladles. MODERN rigidity from monorail track to ladle spout is a timely story...

You can read all about it in catalog 147. It's free to foundrymen who need MORE METAL from FEWER MEN! Just address Dept. F-2, MODERN EQUIPMENT COMPANY, Port Washington, Wisconsin.

MODERN EQUIPMENT CO.

PORT WASHINGTON, WISCONSIN

OTHER CATALOGS, LADLES, 149...
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Stevens Liquid Parting being applied by spray to a matchplate at Wagner Malleable Iron Company's foundry.

ANOTHER SATISFIED *Stevens* CUSTOMER

R. J. Ward, of Wagner Malleable Iron Company, Decatur, Ill., reports: "Stevens Liquid Parting has been used in our foundry for 15 years with very excellent results. We have found we can get cleaner molds, resulting in better castings, using Stevens Liquid Parting, especially on small castings."

Mr. Ward's experience is similar to that of hundreds of users of Stevens Liquid Parting. This thin, transparent liquid can be sprayed, swabbed or brushed on patterns or matchplates to form a tough surface film that assures clean parting and smooth casting finish. It's an all-purpose parting, easy and economical to use. And it's non-toxic by contact or inhalation. Order a quantity of Stevens Liquid Parting. You're sure to be pleased with the results. Call your nearest Stevens representative today or write direct.

EVERYTHING FOR A FOUNDRY

FREDERIC B. STEVENS INCORPORATED

DETROIT 16, MICHIGAN

BRANCHES • SALES OFFICES
BUFFALO • NEW HAVEN • INDIANAPOLIS • CLEVELAND
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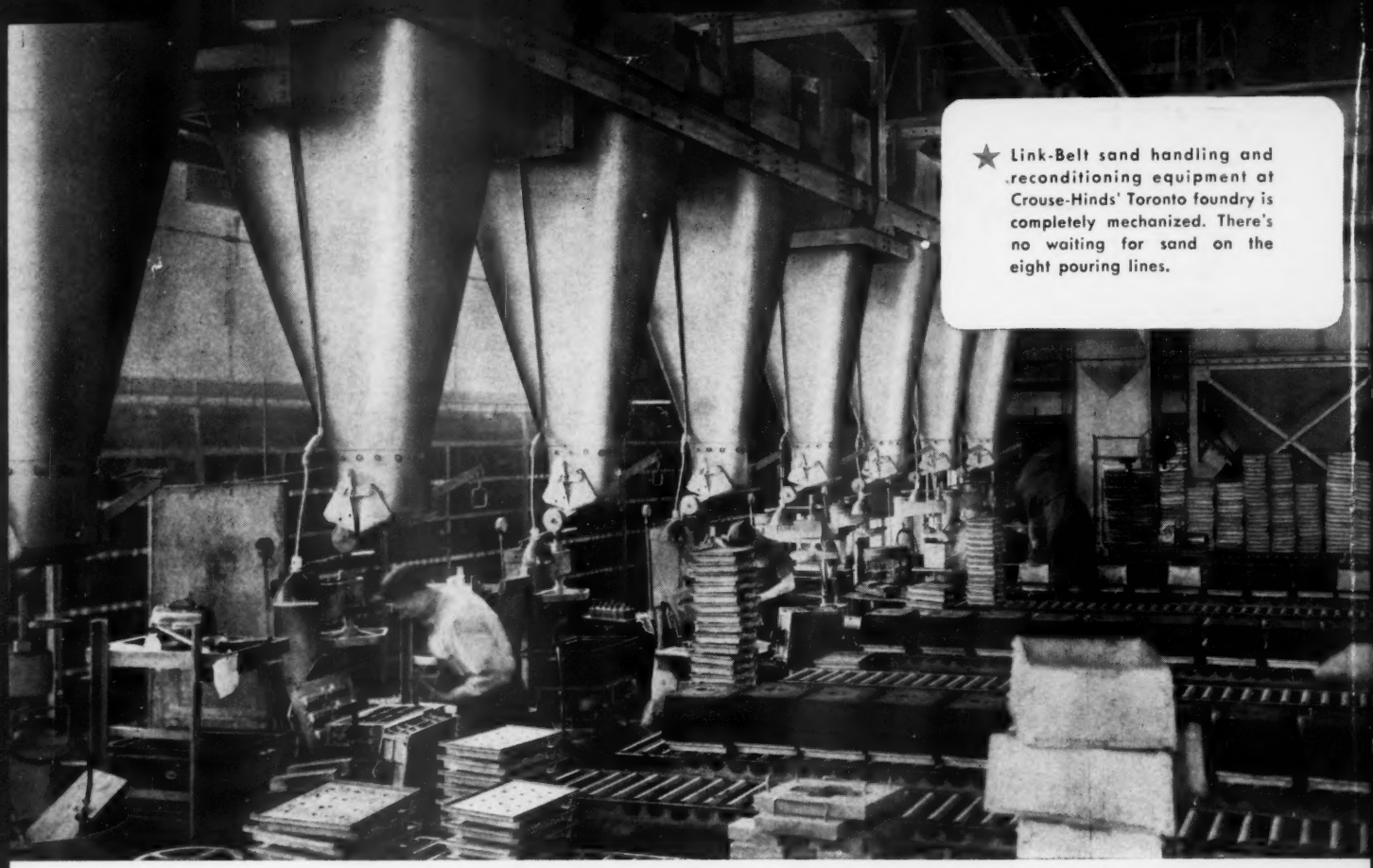

★ Link-Belt sand handling and reconditioning equipment at Crouse-Hinds' Toronto foundry is completely mechanized. There's no waiting for sand on the eight pouring lines.

Another foundry modernizes

with Link-Belt machinery

LINK-BELT mechanization increases output, conserves manpower at Crouse-Hinds of Canada

WHEN Crouse-Hinds Co. of Canada, Ltd. decided to mechanize the foundry at their Toronto plant, they naturally called on Link-Belt. Reason — for 20 years Link-Belt sand conditioning and mold handling equipment in their Syracuse foundry had provided high-efficiency, low-cost service.

Link-Belt engineers took the assignment in stride — utilized every available inch of space — installed automatic sand and castings handling equipment of sufficient capacity for a melt of four tons of gray iron every eight hours. Space is saved because sand is recirculated six times a day — requires less storage and investment in inventory.

Why not put Link-Belt mechanization to work for you? You'll find it does more than increase production. Working conditions are vastly improved. Critical manpower is conserved for its best uses.

Whether your foundry is large or small — gray iron, steel, malleable or non-ferrous — Link-Belt engineering and Link-Belt equipment fill the bill. A foundry specialist will be glad to work with you or your consultant. Your nearest Link-Belt office welcomes the opportunity to give you complete information.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

LINK-BELT

CONVEYORS AND PREPARATION MACHINERY

12.267

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in principal cities

★ Two-way pivoted plow diverts sand coming from Link-Belt reconditioning unit to molder's hopper fitted with convenient, hand-operated gates. An average of 120 tons daily is required.

★ Sand and castings delivered by oscillating feeder conveyor are efficiently separated by Link-Belt Vibrating Shakeout Screen. Bucket elevator then starts sand on its reconditioning cycle.